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LXXVII.

EVALUATION OF THE CALORIC AND ROTATION
TESTS.*

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PHILADELPHIA.

When asking me to deliver a paper on the "Evaluation of the Caloric and Rotation Tests," the committee wrote that "the time had come when this subject could be profitably considered in the light of experiences we had gained since the tests were first devised." I agree with the committee quite heartily. The clinical importance and scope of these tests have undergone such wide changes and such rapid growth since their inception that I feel it would serve the interests of clarity to halt for a moment, in order that we may sift the massive amount of work done and separate the chaff from the wheat.

When Robert Bárány first published a description of the phenomena which resulted from caloric stimulation of the ear, he was hailed by the otologic world as an epoch making discoverer. The caloric test furnished the otologists at last with a true and reliable means of determining the viability of the inner ear and so solved many a vexing problem, especially in those cases where surgical drainage of the labyrinth was contemplated. For a number of years this very important determination was the sole func-

*Presented before the American Otological Society at Briarcliff Lodge, June 19, 1931.

tion of the caloric test, and as a matter of fact, it is even today the most important one. In the development and use of the test by many operators throughout the world, however, additional discoveries and refinements were added until the more enterprising workers began to sense that the caloric test opened a vastly wider field of application.

It was discovered, for instance, that the vertical canals and the horizontal canal could be stimulated separately and that each gave its own characteristic responses, which, of course, implied a separate and distinct innervation for each of these. The normal responses were more nearly standardized and physiologic deviations distinguished from pathologic ones. Careful observations aided by chance discoveries definitely indicated that a certain grouping of the deviations from the normal responses was almost constant in certain types of brain and ear lesions. It is not surprising, therefore, that the subsequent labyrinthine studies based upon the caloric and rotation tests became much more ambitious in their scope. By 1914 these tests actually began to be employed clinically in their broader sense as a diagnostic and prognostic examination for many types of ear and intracranial affections.

There occurred in connection with these tests what often happens to many other new discoveries. Many immature enthusiasms appeared and worked a considerable amount of harm and engendered much confusion and mistrust. The ability to actually diagnose early cases of tumor in the cerebellopontile angle, for instance, as well as in other parts of the brain, gave some otologists a false feeling of omnipotence as intracranial diagnosticians which was most unfortunate. Neurologists and intracranial surgeons, who naturally welcomed an additional diagnostic aid, were thus frequently discouraged by the over enthusiasm of some of their otologic confreres. And so the intervening years have seen its use, and often its abuse, grow wider from year to year, and have witnessed the birth of many hopes and dreams. Some of these hopes have been realized and are today more or less established facts; some have been discarded; others are still only hopes.

It is the tabulation of those dreams which have become more or less established that shall constitute my discussion and shall

have to serve as an evaluation. I hasten to add, however, that because of many natural difficulties, an absolute evaluation of the tests is well nigh impossible. In the first place, most of the cases examined are highly complex, involving many fields of medicine and requiring many special examinations, so that an absolute determination of the importance of any one examination in arriving at a diagnosis and prognosis is difficult. In the second place, comparatively few of the cases come to the operating or autopsy table. In the third place, the tests are very young and admittedly (in spite of all the splendid progress) in their developmental stage, so that any evaluation or analysis must be only relatively exact and more or less flavored by the opinions of the author.

With the foregoing in mind, I shall proceed to outline the clinical sphere of application of the caloric and rotation tests.

1. A very valuable and positive determination accomplished by the tests is that of ascertaining the degree of viability of the labyrinth. In the care of otologic cases, with acute or chronic suppuration, it is frequently necessary to determine definitely whether the inner ear has been involved or not, and if so, to what extent. Where labyrinthine suppuration is suspected, surgical drainage is often a life saving procedure. On the other hand, every labyrinthine suppuration is considered as possibly reparable as long as there is any cochlear or vestibular function remaining. The caloric test is the only means by which one can determine the true condition of the vestibular labyrinth. If upon douching the ear with cold or hot water, nystagmus or vertigo can be elicited from any of the canals, operation upon such a labyrinth is strongly contraindicated, even in the presence of total deafness.

In cases of deafness, toxic or other types, it may be desirable to determine whether the lesion is limited to the cochlear portion of the inner ear, or whether the entire labyrinth is affected. Such a determination may be of great value when considering the question of prognosis. Given a case of total deafness, where the entire labyrinth is found to be nonfunctioning, the probability of recovery is practically nil, whereas, if the vestibular portion of the labyrinth appears to be unaffected, as shown by good, prompt and active responses to ear stimulation, the prognosis may not be so hopeless.

2. The Diagnosis of the Presence or Absence of Cerebellopontile Angle Lesions.—This type of lesion is fairly common, progresses very slowly and usually attains considerable size before general neurologic and clinical phenomena appear. The neuro-otologic picture obtained in cases of a lesion in the cerebellopontile angle readily presents a definite "phenomenon complex" typical and indicative of such a lesion. These findings are: A totally nonresponsive ear mechanism, including the cochlea, on one side—the side of the lesion, while on the opposite side there appears a loss of function in the vertical semicircular canals with the horizontal canal responding well and the cochlea functioning normally. In other words, in a cerebellopontile angle lesion the only portions of the ear mechanism functioning properly are the cochlea and the horizontal canal on the good or unaffected side. In still another way, each case of cerebellopontile angle lesion should show in principle two types of findings:

(a) Typical findings of a peripheral lesion, which is shown by the totally nonfunctioning ear on the affected side.

(b) Definite evidence of a central lesion, which is presented in the loss or impairment of function of the opposite vertical semicircular canals, while the horizontal canal and cochlea function well. Such a combination of both peripheral and central lesion in the same patient is naturally located in the cerebellopontile angle, where the tumor in its growth destroys the eighth nerve and produces a typical picture of a peripheral lesion on that side, and being an intracranial mass, produces in addition pressure phenomena which manifest themselves by various so-called "central lesion findings," among which is a loss or impairment of function from the vertical semicircular canals on the opposite side.

Very few difficulties usually present themselves in the determination of the peripheral lesion element of this "phenomenon complex"—that is, a patient will have a totally nonfunctioning eighth nerve in all of its branches, or if the hearing be partially retained, the responses from the vertical and horizontal semicircular canals on that side will be completely absent, making the evidence of peripheral lesion on that side fairly clear. It is the "central lesion" element of the picture that requires the greatest

interpretive skill. The examiner must be fully convinced that the findings point unmistakably to a central lesion. Loss or impairment of function from the vertical canals of the unaffected side, with good responses from the horizontal canal and good hearing on that side, are the usual findings of a central lesion in these cases. Occasionally, however, these findings are not so clear cut. For instance, the patient's hearing on the unaffected side may not be normal, due to a long standing catarrhal or suppurative process, or perhaps to an old pre-existing eighth nerve or cochlear degeneration. Again, the horizontal canal on that side may respond, but in a manner that would make it difficult to determine that such a response is perhaps not impaired as compared to the fully normal. If such a case presented no other findings indicative of a central lesion, it would be rash to assume that we are dealing with a neoplasm in the cerebellopontile angle. Fortunately, cases of this type often exhibit other phenomena indicative of a central lesion, such as spontaneous vertical nystagmus up or down, or perverted nystagmus obtained on stimulation of the horizontal canal on the unaffected side, or a definitely impaired pelvic girdle movement phenomenon, or a definite disproportion between the eye responses and vertigo responses following stimulation by turning, etc. In some cases the vertical canals of the opposite side retain their function. There, however, the horizontal canal usually responds much more actively, making the contrast in the activity of the responses between the two sets of canals so marked and evident that there is but little difficulty in determining that impairment from the verticals is present.

Since a large percentage of all brain tumors are cerebellopontile angle tumors, a method that is so helpful in either localizing them or excluding them from this region immediately becomes of the utmost importance.

While it is true that the neurosurgeons and neurologists can diagnose cerebellopontile angle lesions in most instances without a vestibular examination, it is equally true that they must wait for the appearance of general clinical phenomena before such a diagnosis can be made. On the other hand, with a vestibular examination a diagnosis can be made rather early—at a time when operation promises the best results. The number of conditions

that could simulate the typical vestibular "phenomenon complex" of cerebellopontile angle lesions are very few, so that the vestibular tests furnish a most definite means of determining the presence or absence of such a lesion. This is particularly important to the otologists, since angle lesions are true otologic lesions because, as a rule, the initial symptoms are deafness and tinnitus, and the otologist is the first physician consulted. Rarely does the otologist feel more chagrined and humiliated than when he discovers that he has advised tonsillectomy, submucous resection of the nasal septum as well as all sorts of eustachian tubal treatment in cases which eventually turn out to be angle tumor lesions and which could easily have been diagnosed as such, if the caloric and turning tests were employed. If these tests could do nothing but determine the angle tumor phenomena complex their contribution on this basis alone would be of inestimable value.

3. The Early Diagnosis of Actual or Threatened Intracranial Invasion in Cases of Middle Ear Suppuration, Acute or Chronic. —Here we utilize our experiences obtained in the course of examination of a large number of cases with proven intracranial lesions. These have enabled us to compile a list of findings that indicate the presence of a brain lesion. The appearance of these vestibular signs in a suspicious ear case often is the basis for diagnosis of central invasion. Thus a patient with middle ear suppuration may present:

- (a) Spontaneous vertical nystagmus.
- (b) A marked disproportion between the duration of nystagmus and vertigo after turning.
- (c) Absence or marked impairment of responses from the vertical semicircular canals, while the horizontal canal responses are prompt, good and active.
- (d) Marked perversion of nystagmus from the horizontal canal after douching—that is, rotary nystagmus instead of a horizontal nystagmus or markedly oblique nystagmus approaching the vertical instead of the horizontal nystagmus.
- (e) Dissociation of eye movements after stimulation.
- (f) A loss of all vestibular responses after stimulation, but hearing good.

(g) Conjugate deviation of the eyes after stimulation instead of a full nystagmus. Any or several of the above phenomena should put the aurist on his guard.

While it is true that the experienced aurist is frequently able to diagnose an intracranial complication based on his clinical experience alone, it is nevertheless also true that in many cases the vestibular examination discovers an actually existing or a threatened intracranial complication long before the appearance of bedside clinical signs.

In the writer's experience, many cases, both acute and chronic, that had no symptoms which would indicate surgical intervention were operated upon because of the presence of the mentioned intracranial vestibular phenomena and in each case the operative findings were very gratifying to the diagnostic accuracy of the tests.

In cases of chronic suppurating otitis media, with or without acute exacerbation, one frequently finds some of the above mentioned intracranial phenomena upon douching the other or good ear, which certainly should never be disregarded and should serve as an indication for immediate surgical exploration of the suppurating ear.

4. In general, neurologic cases where the clinical findings are vague, a vestibular examination will frequently elicit definite signs of intracranial lesion which would serve to put the neurologists on their guard. In later cases, where the general neurologic picture is confusing and where the differentiation between a subtentorial and supratentorial lesion is not clear on neurologic grounds, a vestibular examination can help most definitely in such a differentiation. Occasionally, it is also possible by these tests to either lateralize the side on which the lesion is located or even more definitely help its accurate localization. In this latter field, the value of the examination is still in the experimental stage, and although their uses are not so apparent to the neurosurgeon because of the many advances in brain surgery in recent years, such as encephalography and ventriculography, yet in many instances where the case is doubtful in spite of all the latest surgical studies, a vestibular examination is apt to be most useful

and should rank, on a par at least, with the value of an ophthalmologic examination.

5. A very wide field of application for the tests lies in the diagnosis of the cause of vertigo. It is well to bear in mind that the inner ear is not the entire vestibular mechanism and that vestibular symptoms, such as vertigo in its various forms, disequilibrium, nystagmus, nausea or vomiting, etc., may be produced by a lesion involving any portion of the mechanism—that is, either the inner ear itself or the nerve pathways from the ear, or the nerve centers to which these pathways are disturbed. Furthermore, the vestibular symptoms just mentioned may be produced either by an actual destruction, degeneration, toxic irritation or pressure, involving any portion of the vestibular mechanism. The symptoms of vertigo, nausea, vomiting and various degrees of disequilibrium are more or less the same, irrespective of which portion of the vestibular mechanism is involved. Thus, vertigo as a symptom is the same, whether it is produced by a degenerative labyrinthitis or by a cerebellopontile angle tumor destroying the eighth nerve, or by an infarct, abscess, neoplasm or what not, destroying or compressing any of the vestibular pathways within the brain. All cases of vertigo, therefore, present as one of their first problems the differentiation between affections of the mechanism peripherally (labyrinth or eighth nerve) or centrally (within the cranium). Furthermore, vestibular symptoms may also be produced by a mild irritating toxemia which is either not severe enough or not repeated with sufficient frequency to produce actual damage to any portion of the vestibular mechanism. If we are confronted, therefore, with a case complaining of vertigo or disequilibrium, we employ the tests as follows:

(a) All the vestibular responses might be normal, in which case we would conclude that the cause is some mild toxemia which has produced no damage to the vestibular mechanism.

(b) The examination might reveal abnormal responses which would indicate a damaged mechanism, either in its periphery or intracranially. The differential diagnosis between peripheral and central lesions of the vestibular mechanism is one of the most important tasks with which the neuro-otologist is confronted. The clinical importance of such a differentiation becomes evident

when we realize that the detection of an intracranial or central lesion may mean an immediate recourse to brain surgery, while the diagnosis of a peripheral lesion would permit of leisurely study and medical care, either aural or general systemic.

All these problems in relation to vertigo cannot be studied intelligently except through a careful examination by the rotation and caloric test. The only other method of examination of the vestibular mechanism—the galvanic test—is not sufficiently selective to permit of an accurate diagnosis of the location of the lesion in vertiginous cases.

Briefly summarizing by way of conclusion, we find that in the hands of the most expert examiners the caloric and rotation tests serve as follows:

1. To diagnose the causes of vertigo in general.
2. To differentiate between supratentorial and subtentorial lesions in doubtful neurologic cases.
3. To aid in the localization of intracranial lesions.

However, even in the hands of those only moderately expert the tests can serve in a most definite manner as follows:

1. To ascertain exactly the degree of viability of the labyrinth.
2. To establish or rule out the existence of cerebellopontile angle lesions.
3. To detect early an actual or threatened intracranial invasion in cases of middle ear suppuration, acute or chronic.

1820 SPRUCE ST.

LXXVIII.

OSTEOMYELITIS OF THE SKULL: THE OSTEO-
GENETIC PROCESSES IN THE REPAIR
OF CRANIAL DEFECTS.*

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Numerous references to osteomyelitis of the skull secondary to nasal sinus and aural suppuration are found in the medical literature. Tilley,¹ in 1889, was the first to observe the occurrence of osteomyelitis of the frontal bone as a complication of paranasal sinus suppuration. McKenzie,² in 1913, published a comprehensive discussion of the subject and added to his experience and opinions those of Gerber,³ Luc,⁴ Knapp⁵ and Schilling.⁶ Bulson,⁷ in 1925, wrote a complete review of the literature on osteomyelitis of the frontal bone, to which he added clinical observations of a most instructive character. Skillern,⁸ in 1929, called to our attention a very interesting case of diffuse osteomyelitis of the cranium and reported a comprehensive study of the clinical aspects of this rare but serious complication of nasal sinus suppuration. Publications on the subject have also been made by Lillie,⁹ Flemming,¹⁰ Frey,¹¹ Blair and Brown,¹² Hastings,¹³ Dabney,¹⁴ Shea,¹⁵ Connor,¹⁶ Thomas and McKenzie,¹⁷ Mason,¹⁸ Meyers,¹⁹ Hanson,²⁰ Gelanze,²¹ Campbell,²² Woodward²³ and others. These authors have recounted their personal experiences with one or more cases of this malady and have furnished valuable contributions to our knowledge of osteomyelitis of the cranial bones.

There remains, however, a wide diversity of opinion in respect to many phases of this disease. Views on etiology have afforded interesting comment. The mode of spread of infection through the cranial vault has been exposed to much speculation, and methods of treatment have ranged from ultra conservative meas-

*Presented before the thirty-seventh annual meeting of the American Laryngological, Rhinological and Otological Society, St. Louis, June 3, 1931.

ures to radical surgical procedures of a most formidable character. Thus a study of the literature is prone to invoke in the minds of the readers a state of confusion, although to one endowed with a practical sense of value comes the feeling that clinical studies, appearing in scattered reports on the subject, have given rise to a number of definite observations concerning which most authors are in accord and from which lessons of a practical value may be derived.

In entering into a general discussion of this subject an attempt is made to relate a number of observations revealed in a clinical and pathologic study of fourteen cases of osteomyelitis of the cranial bones. Obviously some of the data herein compiled will serve only to reiterate the expressions of previous observers. A repetition and overlapping of opinions is the inevitable consequence of a study of such wide scope, especially where there are in existence innumerable confusing theories and few scientific facts. It is hoped, however, that a more analytical survey of the anatomic and pathologic features of this disease will in some measure contribute to our knowledge of the subject and serve to justify another discourse on osteomyelitis of the skull.

As a preliminary to this discussion, let us briefly enumerate some of the clinical observations appearing in our medical records to which most authors agree.

The disease is considered rare. There are but 73 cases of osteomyelitis of the cranial vault appearing in the medical literature to date. When one takes into consideration the frequency with which suppurative processes are observed in the cavities of the skull, it is true that osteomyelitis of adjacent bones of the cranium is of infrequent occurrence. It is a noteworthy fact, however, that nearly every otolaryngologist with whom this problem is discussed describes at least one personal experience with this serious complication of nasal accessory sinus suppuration. It would appear that only a small proportion of the total number of cases of osteomyelitis of the cranial vault has ever been placed on record in the medical literature.

It has been said that the disease is most common during early life. From a statistical standpoint, this would appear true, for most of the reported cases have occurred during childhood or

early adult years. In explanation Woodward states that, "since the diploë is most marked in adolescence and early adult life one would expect to find the disease most frequent at these periods." In our series of cases eleven occurred before the twenty-fifth year, one at the age of 32, another at 47 and a third during the fifty-sixth year of life.

Of unusual interest are the alarming reports of the frequent occurrence of osteomyelitis of the frontal bone following operations upon the frontal sinuses. It has occurred as a sequel to the intranasal as well as the external approach. It has developed in the hands of master surgeons, as well as in those of less surgical skill. No one is immune to this serious accident and none of our profession has yet offered a precise explanation for the influences which contribute to the development of this dreaded complication. We have been satisfied to relegate this problem to the old doctrine of infection plus a prepared soil. What error of omission or commission in our surgical attack upon the frontal sinuses is responsible for the extension of infection to the adjacent cranial bones? The answer is yet unattainable, though the question is one of absorbing interest to those who have witnessed the spread of infection to neighboring bones subsequent to their own surgical efforts upon the nasal accessory sinuses.

In the matter of etiology we turn to a study of the pathologic processes involved in the extension of infection beyond the boundaries of the frontal sinuses. Most apparent is the spread of infection by continuity of tissue.

We regard these sinuses as eroded diploë, the outer walls corresponding to the external plate of the cranial bones, the inner walls comprising the internal table of the cranial vault. Obviously a collection of pus within these boundaries may, under favorable conditions, find little resistance to its escape to the adjacent diploë of the frontal bones. Here, too, we may find certain anatomic relations which tend to expose the spongy tissues of the calvarium to infection by direct extension from the frontal sinuses. In serial sagittal sections of fifty skulls I have found a variety of anatomic variations which would seem to exert some influence upon the spread of infection to the adjacent diploë.

In most instances the frontal sinuses, both large and small, are completely surrounded by a layer of compact bone, while in others there is an abundance of spongy tissue in both the anterior and posterior walls of the sinuses in close proximity to the lining mucous membrane. The latter factors, together with the retention of inflammatory products in the frontal cavities, is no doubt of some importance in influencing the behavior of bone infection, especially when surgical trauma and lowered constitutional resistance have prepared the soil for the invading organism.

When, following an operation upon the frontal sinuses, signs and symptoms of suppuration persist as a result of ineffectual drainage, I am convinced that the surgeon has produced a serious complication. The diffusion of the process is obviously favored by the retention of inflammatory secretions within the sinus cavities, and it is precisely under such condition that osteomyelitis of the cranium has been observed to show a rapid or rather more often a slow, insidious development. Continued evidence of inflammation subsequent to the first surgical attack calls for an early secondary operation, since delay in establishing satisfactory drainage exposes the adjacent bones to the ravages of infection.

Having recognized the importance of infection by continuity of tissue, we now turn to a consideration of the second mode of extension, namely, that of hematogenous metastasis. In this study are found many of the most interesting observations.

That infection may be carried to various bones of the cranial vault through the blood vessels supplying these tissues is a fact not difficult of proof. It is the only means of dissemination that accounts for certain clinical findings, namely, isolated foci of osteomyelitis in remote bones of the skull and the occurrence of osteomyelitic processes secondary to severe systemic infections such as the acute eruptive fevers. Cranio-tabies, that ravaging form of syphilis in osseous tissue, dramatizes the extent to which a blood borne infection may destroy large parts of the calvarium. By the same token, we watch with interest the amazing effects of antisyphilitic medication carried to these tissues through the same vascular systems which previously spread the infection.

There are, moreover, a number of pathologic changes in the osteomyelitic skull which give evidence of hematogenous dissemination of infection, to which further reference will be made. Suffice it to say that the behavior of suppurative processes in the cranial vault, from a clinical and pathologic point of view, give rise to the personal conviction that the hematogenous spread of infection is not uncommon and consequently an important influence in the production of the diffuse form of cranial osteomyelitis.

In this connection particular reference is made to the part played by the intracranial diploic veins in the dissemination of infection to the cranial bones. Here we are concerned with a more local process in which the inflammatory disease is carried into the bones of the calvarium through the anastomosing diploic veins on the under surface of the cranium. The pathologic process is essentially a thrombophlebitis of the venous system, which drains the bones of the skull and empties into the intracranial sinuses.

As a preliminary to a further discussion of this process, let us recall in a general way the anatomy of the vascular systems which supply and drain the vault of the skull. It must be remembered that the bones of the cranium derive nearly all of their blood supply from the arteries within the cranial cavity and that the venous return is back to the large intracranial sinuses. In other words, the skull cap gets most of its nourishment from the inside of the head and returns its venous blood in the same direction.

The external periosteum has little to do with the life of the cranial bones, though statements to the contrary have often appeared in the medical literature. It is not essential to the nourishment of the calvarium nor, as will be demonstrated later, is it a prerequisite in the processes of repair. Large areas of periosteum may be stripped from the cranial vault without seriously affecting the underlying bones, and it is highly probable that its influence is of little consequence in suppurative processes of the osseous tissue, from the cranium.

The dura or internal periosteum, on the other hand, performs an exceedingly important function in the life of the cranial

bones. It conveys nearly all the blood vessels to and from the cranial vault and assumes an interesting rôle in the osteogenetic processes of repair. It is a vital part of the bones to which it is closely attached, and therefore an influence of great importance in the pathologic changes which lead to bone destruction.

With these anatomic relations in mind, let us turn now to a more precise description of the pathologic and clinical phenomena observed in some cases of diffuse osteomyelitis of the skull. There is considerable proof for the opinion that in many instances the suppurative process starts its invasion on the under surface of the cranium. It originates as a thrombophlebitis of the diploic veins, penetrating the cerebral wall of the frontal sinus and spreads throughout the diploic system of anastomosing vessels within the dura mater. Retrograde thrombosis, a process commonly observed in nearly all forms of thrombophlebitis, subsequently carries the infection into the diploic system which lies within the spongy tissue of the calvarium between its outer and inner plates. Thus there are established the initial changes of an osteomyelitis within the diploë of the cranial vault. The medullary tissue becomes filled with purulent granulations, the lamellæ break down and there are formed osseous sequestra, some of which may be discharged, while others are resorbed and finally disappear. Where there is a tendency to spontaneous healing, the granulations in the diploic spaces are converted into fibrous connective tissue. When this process establishes itself at the limiting border of a suppurative lesion, a dense layer of compact bone may subsequently develop. Such a change constitutes a most effective protective mechanism on the part of nature to arrest the progress of the disease. It is virtually a bony sclerosis, a defense tissue developing in some vague manner through histologic processes which are not yet definitely understood.

Opinions to the contrary, one may find evidence of bone regeneration in many of the active lesions of osteomyelitis. The process of embryonic bone formation and that of osseous destruction go hand in hand, though the latter is predominant.

With further infiltration of the inflammatory disease, the inner and outer plates of the cranial bones are lost. On the dura a cushion of purulent exudate forms, which rapidly tends to organ-

ize, but exerts a destructive influence upon the inner table of the cranium. It is quite probable that this pathologic change upon the dura is in no small measure responsible for further extension of the infection. It often appears to develop in advance of the necrotic bone and to separate the dura from the cranial vault ahead of the osseous infection. Such an exudate between dura and skull tends to cut off the chief blood supply of the cranial bones and thereby deprive them of adequate nutrition. Likewise, it would tend to favor the formation of septic thrombi within the intracranial diploic veins which it surrounds as it advances on the external surface of the dura.

When the external plate and periosteum are destroyed, the inflammation spreads to the soft parts of the head, producing the typical clinical signs of edema and swelling. A puffy swelling with subsequent abscess formation in the soft tissues is the characteristic external manifestation of the disease. The latter perhaps exerts but little influence upon the further spread of infection through osseous tissue. Simple drainage of large collections of pus in the soft tissues of the cranium does not act as a deterrent to further invasion of the underlying bones.

In support of the view that some osteomyelitic processes occur primarily as a thrombophlebitis of the intracranial diploic systems, the following pathologic studies are enumerated.

First.—This mode of extension seems to offer the most logical solution for the occurrence of isolated foci of osteomyelitis in the cranial bones. Here we may find an osteomyelitic lesion somewhat removed from the primary infection and separated from the latter by a zone of healthy bone. Some difficulty would arise in attempting to explain this phenomenon on the basis of infection by direct continuity of tissue.

Second.—Postmortem examinations not infrequently reveal a thrombophlebitis of the intracranial diploic veins in advance of bone suppuration. Here, too, we may find an exudate of varying thickness and in various stages of organization spreading over the dura ahead of the inflammatory process in the overlying osseous tissue. The latter may show a fibrous connective tissue organization of at least several days' duration, though the portion of the cranial vault immediately over this process may be found

microscopically free from an osteomyelitis. Such pathologic findings at autopsy could lead to but one logical conclusion: that the extradural exudate and the inflammatory changes within the diploic veins are evidences of a primary invasion of this region and not a secondary development in the course of a suppurative disease of the cranial bones.

Third.—One may find in pathologic studies of osteomyelitic lesions innumerable signs of early injury to the inner table of the calvarium. In fact, I think it may be correctly said that the inner plate is the first to be destroyed. But what is still of greater significance is the fact that the inner table may be the only part of the bone primarily affected while the more superficial medullary tissue and external plate may remain uninvolved. In this alone, we find considerable proof of a primary intracranial yet extradural origin of an infection that may subsequently erode and destroy the entire cranial vault.

In relating the above observations, I do not wish to minimize the importance of infection by continuity of tissue. Rather do I wish to call attention to a certain aspect of this infection concerning which we are still much in the dark though it seems to open a field for further investigation. A certain, though perhaps small, number of osteomyelitic lesions of the cranial bones are in a broad sense chargeable to an infection primarily of intracranial origin.

We come now to a consideration of the influences if any exist, which tend to limit the spread of infection through the cranial vault. Reference is frequently made to two classifications of the disease, the diffuse variety of osteomyelitis and the spreading type. I have serious doubts that as such they are truly clinical entities. On the one hand we have an infection which by reason of its great virulence and because of a poor constitutional resistance on the part of the patient spreads wildly through all of the osseous tissue which lies in its path. In another instance, because of less favorable influences to bacterial invasion, the disease limits itself to a part of the cranium and shows a tendency to spontaneous resolution.

In some cases the cranial sutures seem to exercise an inhibiting influence upon the spread of infection. Histologically, a serrated suture consists of a zone of highly vascular connective tissue,

bounded on both sides by a dense layer of compact bone. It is a clearly differentiated tissue and by reason of its microscopic structure may possibly function as a barrier to the diffusion of an osteomyelitic process to adjacent cranial bones. To be sure, the disease may, and often does, invade the entire cranial vault, though there is clinical and pathologic evidence that the sutures occasionally tend, at least for a time, to arrest the progress of the infection.

Radiographic studies of an osteomyelitic lesion not infrequently show the process for a variable time, limited along the line of a serrated suture. Microscopic sections of a decalcified bone in this region are even more conclusive in that they often reveal an active infection over a broad line of advance conforming to that of the suture but limited entirely to one bone.

If this observation has been correctly made, it suggests, perhaps, a point of value in surgical technic, namely, to limit the removal of bone in operations upon these processes to a suture line whenever it is practicable.

The dura, which is at first highly resistant to the infection, finally yields to the invasion. A diffuse purulent meningitis or a brain abscess are the common sequelæ. Not infrequently the large cerebral sinuses are invaded and thrombophlebitis with septicemia brings the patient's life to an end. Most devastating in its effect is the spread of infection towards the base of the skull into the frontal plate of the frontal bone, ethmoids, lacrimal and sphenoid bones. Extension in this direction is prone to eventuate in a fatal intracranial complication.

The treatment of osteomyelitis of the cranial vault calls for surgical interference of a most formidable character. The disease is a highly destructive one and does not show a tendency to spontaneous resolution. The only hope for the patient's recovery lies in the radical removal of that portion of the cranial vault which is the seat of infection. Both outer and inner plates are removed and the resection is carried well beyond the obvious limits of the disease. For reasons already described, it often seems feasible to limit the resection of the cranial bones to a suture line.

Where larger areas of the calvarium are removed, surgical shock and hemorrhage are the immediate complications. Every effort is made to combat shock, and blood transfusions are given while the operation is in progress. In most cases it is safer to perform the operation in two or three stages, at intervals of five to seven days, rather than to attempt to attain the objective at one sitting in the face of increasing shock or hemorrhage.

Acraflavin packs are placed between the scalp and dura and allowed to remain for from three to five days. Following their removal, the wounds are irrigated daily with Dakin's solution. The incisions in the scalp are partly closed with free drainage at their dependent extremities.

In our experience, vaccines and intravenous medication have been of little value. In the presence of anemia from hemorrhage and infection we resort to frequent blood transfusions and the oral administration of some form of iron. The two iron preparations which are used are ferric ammonium citrate, 50 per cent aqueous solution, drams one, twice a day, or ferrum reductum, six-tenths grams (.6 grams) in capsules twice daily. No advantage appears to be derived from giving these medicinal agents intravenously.

One phase of this interesting subject which seems to present unusual opportunities for further investigation is that of tissue repair.

The medical literature contains numerous but rather brief references to the reparative processes in osteomyelitic defects of the skull, but little has been published concerning the frequency of bone regeneration, the mode and extent of restoration and the circumstances under which the process of repair is best favored.

It has been inferred that bone formation can only be expected to occur when the inner table of the skull is allowed to remain intact. It has been further stated that the osteogenetic function of the periosteum is essential to cranial bone proliferation. While the periosteum and the inner table are germinal tissues from which bone proliferation occurs, it can also be said that these two elements are not entirely essential to cranial bone regeneration.

The dura, particularly its outer layer, which is virtually a periosteal element, is, under favorable conditions, an exceedingly active regenerative tissue. This function of the dura mater has been frequently observed in patients who have been exposed to more than one surgical procedure in which the interval between operations has been long enough to permit of osteogenetic evolution.

Turning now to a discussion of the frequency of bone regeneration in defects of the cranial vault, we are confronted with actual evidence of its common occurrence. There is definite osteologic evidence of bone regeneration in prehistoric skulls now on exhibition in many of our pathologic museums. Studies in paleopathology clearly demonstrate that trephining for relief of depressed fractures or for religious purposes was often performed by prehistoric surgeons. It was one of the earliest surgical procedures, and restoration of bone in many of these defects is clearly demonstrable. The reparative process is likewise interesting evidence that the patient often survived the operation.

In the anatomic museum at the University of Michigan there is an unusual collection of skulls showing many forms of fracture of the cranial vault. In most of these specimens the injuries are very extensive with widely separated fragments of bone. It is of extraordinary interest to note that in most of these preparations there is more or less firm fusion of the bony fragments through the medium of osseous regeneration. The collection not only presents a great variety of anatomic curiosities but affords convincing evidence that osseous union of widely separated fragments of flat bones is not a rare occurrence.

A striking example of osseous repair is frequently observed in operative defects of the temporal bone. In secondary operations upon the mastoid process the aural surgeon is often amazed at the extent of bone regeneration. In many instances, particularly in infants and young children, the repair is nearly complete. As a consequence, the young otologist of limited experience is sometimes prone to regard with suspicion the ability of the surgeon who performed the primary operation. His critical sensibilities are often dulled, however, when, through wider experience he eventually comes face to face with a similar situation

developing entirely under his own observation for which there is no one else to share the responsibility. He is amazed to find in his second operation upon the mastoid process the extensive repair of the defect produced by his first surgical endeavor.

Neurologic surgeons will bear witness to the fact that restoration of the cranial bones is not a rare occurrence. Cushing has said that on one occasion, while performing a secondary cerebellar decompression he exposed bony regeneration which completely filled the primary defect. The osseous repair was of such perfection as to warrant the claim that a previous operation had never been done had he himself not performed the original decompression.

For consideration of the data which follows, the writer has chosen from the records of University Hospital fourteen cases of osteomyelitis of the cranial vault, which he has personally observed.

While statistics compiled from this small group of cases make no presumptuous claims, they serve to demonstrate in a measure not only the frequency of cranial bone regeneration but also the extraordinary extent to which this process may be carried. Twelve patients in this group were subjected to radical surgical interference, in which all of the infected bone was removed. The extent of operation varied from partial removal of the frontal bone in one patient to a most formidable procedure approaching complete craniectomy in another. In every instance an effort was made not only to dispose of all bone which was obviously the seat of an osteomyelitis but to widen the margin of safety through the removal of a surrounding zone of osseous tissue, which to the naked eye, seemed free from infection.

The youngest patient was six years of age, the oldest fifty-six.

Frontal sinus suppuration was the etiologic factor in ten patients, maxillary sinusitis in one, trauma in another and aural suppuration in two patients of the series.

Of this group there were eight recoveries and six deaths.

The group of eight patients referred to as recoveries has been returned to the clinic within the past year and subjected to careful clinical and radiographic examinations. I feel free to declare

these patients cured, since all are without recurrence at the end of a period exceeding two years.

Turning now to our first consideration, namely, that of the frequency and extent of bone regeneration, one sees it strikingly exemplified in the above series of cases. In each of the eight patients now living and well, there is perfect obliteration of the cranial defects through the medium of regenerated bone. This varies from a closure of small defects in the frontal bone to complete restoration of the cranial vault following partial craniectomy. Clinical examination alone is convincing proof of the degree of repair. Radiographic studies on these patients are confirming evidences of cranial osteogenesis.

Contrary to the above contentions, the writer has found statements in two anatomic texts to the effect that the flat bones of the skull do not regenerate. Commonplace observations of reparative processes of the cranium do not appear to substantiate this teaching.

Let us consider the mode of repair. The regenerated bone has for its origin a connective tissue groundwork. The fragments and shreds of traumatized periosteum remaining within the wound become thickened and congested, and assume the appearance of granulation tissue. The latter serves as a young connective tissue base of an embryonic character in which ossification may follow. There is a rapid multiplication of connective tissue elements with a differentiation of some of the cells into osteoblasts. Thus there is formed an interlacing framework of trabeculae which is at first uncalcified and is spoken of as osteoid tissue. The latter is soon infiltrated with calcium salts and there are formed numerous trabeculae, or spicules of bone, completing the process of ossification.

Obviously a detailed description of the histiologic phases of bone regeneration is not within the scope of this paper. Suffice it to say that the development of new bone from the periosteum of the skull is identical with that observed in the long bones of the body.

Into this phenomenon of bone regeneration I wish to introduce an observation which seems to me to be of striking interest, name-

ly, that the dura mater may serve as a medium of osteogenesis precisely as above described for the periosteum.

In three of our patients, subjected to repeated operations, there were wide dural exposures, and the ossification of granulation tissue arising from the dura was clearly demonstrated. A connective tissue groundwork developing on the dura and far removed from periosteum was observed to assume an embryonic character and to pass through the typical modifications of bone growth.

This observation, interesting as it may appear, is no justification for the assumption that the dura as such is actually an osteogenetic medium. There is scientific proof of unassailable character that the periosteum alone does not possess the function of osteogenesis.

Physiologic studies upon periosteum which has been carefully stripped from the underlying bone clearly demonstrate that it is not capable of bone regeneration. When, however, flakes of bone of gross or microscopic dimensions remain attached to the periosteum the latter may then function in the processes of bone evolution. Doubtless the same holds true for the dura mater. The deposition of bone debris upon the dura in the course of trauma to the cranial bones supplies the ossifiable element essential to bone regeneration.

While it may be true that any tissue of a connective tissue type in the neighborhood of the cranial bones may, under certain conditions, assume an osteogenetic function, it is a noteworthy fact that regeneration usually begins away from the periphery of the defect. It is seldom observed that the bony margins of osteomyelitic cavities give rise to newly formed bone. This phenomenon has been frequently observed clinically and in repeated radiographic examinations during the process of repair.

Young bone casts a diffuse shadow which is more transparent than normal bone. The new formed trabeculae are clearly differentiated from adult bone, so that more or less accurate determination of the position and direction of osseous regeneration can be made in the ordinary roentgenogram.

From these studies it would appear that the proliferation of bone usually occurs from isolated fibrous connective tissue ele-

ments within the cranial defect. When upon clinical examination repair seems complete, radiographic studies usually demonstrate a clear zone of separation between the margins of the new formed osseous tissue and those of adult bone.

It remains for us to mention a phase of the subject previously referred to, namely, the conditions under which bone regeneration is best favored.

The present unsatisfactory and unsettled knowledge of this problem precludes the possibility of adding many facts to this phase of the discussion. It may be pertinent, however, to state that there are a number of well recognized general conditions which tend to influence the mechanism of osseous repair.

No one can doubt the influence of age upon ossification. The younger the patient the better the repair, is almost a surgical axiom. It is interesting to note, however, that in the series of cases above mentioned complete restoration of the cranial vault occurred in an individual at the age of forty-six.

The effect of nutrition is well understood. Patients who are nutritionally impoverished by disease are poor subjects for osseous repair. The privations of famine and war have clearly demonstrated the effect of inadequate nutrition upon the healing of fractures.

The influence of heat, light and massage is unquestionable. Blistering over the fracture and the partial use of an extremity gave certain benefits which have long been recognized by the general practitioner.

In the most recent patient of our series it was interesting to note the extraordinarily rapid formation of bone during the daily application of heat from an infra-red lamp. In this particular instance no one would question the possibility of coincidence. Nevertheless, we cannot pass by without recognizing the influence of hyperemia upon tissue repair.

Lastly, we must add that infection as a deterrent to bone regeneration is an all important factor. The presence of pus, necrotic tissue and bony sequestra tend to frustrate the processes of repair. The elimination of these pathologic changes through radical surgical interference, wide open drainage and cleansing

irrigations is a surgical principle of paramount importance. In summarizing our views on bone regeneration, we draw the following conclusions:

First.—We are alarmed at the frequent occurrence of cranial osteomyelitis following operations upon the nasal accessory sinuses. What error of omission or commission in our surgical technic is responsible for this grave accident? We are much in the dark concerning this question, though it opens an important field for further investigation.

Second.—While infection by continuity of tissue is perhaps the common form of extension, some cases of osteomyelitis of the skull are definitely chargeable to an infection which spreads between dura and bone, eroding the latter by pressure or infecting it through a thrombophlebitis of the intracranial diploic veins. There are a number of pathologic studies which suggest this mode of diffusion.

Third.—Treatment calls for the radical removal of the full thickness of all diseased bone. In severe cases a two or three stage operation is recommended.

Fourth.—That the regeneration of bone in osteomyelitic defects of the skull is a frequent occurrence. There need be no apprehension in the radical removal of large portions of the cranial vault, since repair is often complete. Likewise plastic procedures for the obliteration of cavities in the skull by the use of free transplants of bone are seldom indicated.

Fifth.—Any tissue of a fibrous connective tissue type in the region of a cranial defect may participate in the evolution of bone. Periosteum is the classical example, although the dura mater may play a similar rôle in osseous regeneration.

Sixth.—There are a number of general conditions which definitely influence the proliferation of bone. The effect of nutrition, mechanical irritation, heat, light and infection is unquestionable. The knowledge of these influences is commonplace. This reiteration seems justified as a plea for further investigation and a more scientific understanding of those factors which influence tissue repair.

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LXXIX.

RHINOSPORIDIUM.*

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EAST ST. LOUIS.

My patient, a seventeen-year-old boy, came for examination on September 30, 1930. He complained of the right side of his nose being stopped up to a degree which interfered with his breathing through the right nostril.

He first noticed his nose discharging and stopping up while a resident of Springfield, Mo., in July, 1930. He suffered from frontal and occipital headaches and frequent nose bleeds. In September, 1930, he noticed for the first time the growth in the right side of his nose, which he could palpate with his little finger. He further stated that he smokes about one package of cigarettes a day.

He was born in East St. Louis, Ill., on May 19, 1913, and attended the public schools in that city. He gave a history of having suffered the usual diseases of childhood and stated that his father had a grocery store and delivery service, using horses, and his duty was to take care of the horses. He has had a dog for a pet ever since childhood.

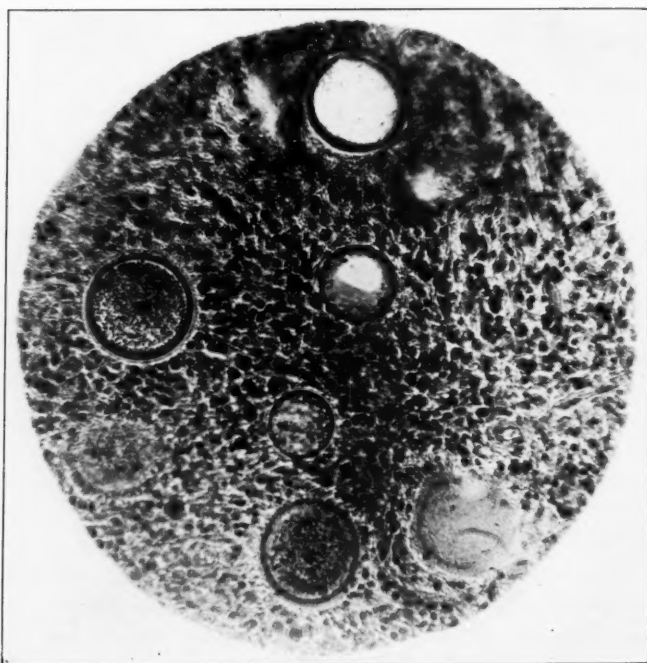
Examination of the nose showed a tumor the size of a large pea attached by a small short pedicle to the mucous membrane of the right side of the nasal septum, near the junction of the cartilage and the vomer. It was of a dark red color with an irregular surface and rather freely movable. It was located about one-half inch above the floor of the nose and did not bleed upon manipulation. There were no signs of a tumor on the other side of the septum. There was considerable pus in each middle and lower meatus, and the nasal septum was deviated to the right anteriorly moderately. Moderate hypertrophy of each lower turbinate.

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Upon posterior rhinoscopic examination was seen a moderate size mass of infected adenoids and considerable hyperplasia of each side of the septum.

Examination of the throat revealed lower half of each tonsil remaining, following a tonsil and adenoid operation ten years ago.

Examination of the ears was negative.



On October 27, 1930, the tumor was removed with a nasal snare under novocain 1 per cent anesthesia. There was moderate bleeding. It was packed with vaselin gauze, and on November 1, 1930, the site of the operation was healed.

On January 21, 1931, there was no recurrence.

Pathologic examination revealed this to be *rhinosporidium seeberi*.

So far as I have been able to determine, this is the third case of rhinosporidium seeberi reported in the United States.

Pathologist's report (D. L. Harris, M. D.):

The specimen is a solid oval grayish white polyp-like body, measuring about 10 by 7 by 4 mm. No pedicle can be recognized.

In sections there are numerous cysts which measure from 20 to 100 microns in diameter. The larger have a well defined double walled capsule within which are sporulating granules in various stages of development. In some the wall is found to be ruptured, from which the spores are flowing out into the surrounding tissue.

The local reaction is relatively slight and consists of small foci of lymphocytes. No leucocytes or other evidence of suppurative processes are seen.

The microscopic appearance of the cysts is identical with that described as rhinosporidium.

Diagnosis: Rhinosporidium.

This condition was first described by Seeber in Buenos Aires in 1900, in his thesis for the degree of Doctor of Medicine, at the University of Buenos Aires. The parasite was not named until 1903, when his teacher, Prof. Wernicke, named the parasite coccidium seeberia. Seeber removed a large polyp from the patient, who was a native of Italy, and the removal was attended with considerable bleeding.

In 1903, O'Kinealy, who did not know of Seeber's case, described "localized psorospermiosis of the mucous membrane of the septum nasi." His patient was a male, age 22 years, who came to him on May 12, 1894, on account of a growth in his left nostril. Three years previous to his operation he had been employed in a hide store for a period of 18 months. It was removed in a hospital with forceps again some time later by a native barber and several months later by O'Kinealy. He writes: "A small vascular pedunculated tumor, about the size and shape of a large pea, was seen projecting into the vestibule of the left nasal fossa. It was a freely movable, painless growth, with the appearances of a papilloma, and was attached by a short pedicle to the mucous membrane at the anterior and upper part of the cartilaginous septum, being entirely confined to that region. The remainder

of the upper respiratory tract was healthy, and no evidence was found of any disease elsewhere. The growth was easily and apparently completely removed by forceps and the cold snare, though it was composed of friable tissue, which bled rather freely."

He was inclined to attribute the origin to direct infection from the raw hides among which the patient was working at the time that he first noticed the growth.

E. A. Minchin and H. B. Fantham, in 1905, described a rhinosporeidium Kinealyi as "a new sporozoon from the mucous membrane of the septum." Their studies dealt with Major O'Kinealy's specimens and they described in detail their microscopic findings, which are as follows:

"In the foregoing the authors have set forth the facts observed in a purely objective manner, so far as possible. It will now be useful to recapitulate and summarize their observations, and to construct what appears to them to be the developmental sequence of events, as a preliminary to the discussion of the affinities of the parasite.

(1) The youngest forms the authors have observed with certainty are granular protoplasmic masses of irregular or even amoeboid contours, enveloped in a hyaline membrane, and probably multinucleate. These bodies represent the early trophozoite stage, and occur in the submucous connective tissue, as do all other forms of the parasite, a few fully developed forms being also seen in the epithelium.

(2) The parasite increases in size, its hyaline envelope becomes thicker, forming a definite cyst-wall, and towards the center of the body the protoplasm becomes segmented into spherical masses, each with a single nucleus and a delicate membranous envelope. As these bodies are destined each to give rise to numerous spores, they may be termed *pansporoblasts*, a word in use for the similar structures in the Neosporidia. Formation of the pansporoblasts goes on continually from the center towards the periphery at the expense of the peripheral zone of protoplasm, which is at the same time growing and causing the cyst to increase in size as a whole.

(3) Pansporoblasts give rise to minute spores in their interior, first to one or two, then to a gradually increasing number, till about a dozen are found in each pansporoblast, forming a spore-morula. The spores are minute rounded bodies, each with a single nucleus. The oldest pansporoblasts are towards the center, the youngest at the periphery, thus forming the three zones described above. The peripheral zone of protoplasm becomes reduced to the vanishing point, and as the cysts do not exceed a certain size, it is perhaps used up entirely in the formation of pansporoblasts.

(4) In many cases it is evident that the cysts burst and scatter the spore-morulae in the surrounding tissues. It is highly probable that this represents the usual method of endogenous reproduction of this parasite, both on account of the very great number of cysts present in the tumors, and from the tendency of the tumors to recur after extirpation. Thus in

the original growth removed by O'Kinealy signs of recurrence were observed in less than a month after the operation (1). With more experience, removal of the tumor with cauterization of the base was found to be the best form of treatment (2), which shows clearly that unless the parasite be extirpated completely, it will multiply and produce fresh growths. The authors are unable, however, to bring forward any observations upon the manner in which the spore-morulae give rise to new generations of parasites. And the method by which the parasite succeeds in infecting fresh hosts must remain for the present a complete mystery.

From the preceding summary it is evident that this parasite must be placed in or close to the subclass Neosporidia of the Sporozoa. The multinucleate trophozoites of irregular form; the progressive and continuous spore formation, commencing at an early period in the growth of the parasite; the formation of uninucleate habitat of the parasite in the submucous tissue—these are points which are diagnostic, or at least characteristic, of the Neosporidia. On the other hand, its position in the subclass is less clear. The amoeboid trophozoite and the minute spores recall the polysporous Microsporidia, but a sharp difference is seen in the absence of any pole-capsule in the spores, a feature which distinguishes *Rhinosporidium* from each of the three orders included in the neosporidia. Moreover, Microsporidia are not known to occur in any warm blooded vertebrate, in which class of hosts the Sarcosporidia seem to take their place, but it cannot be said that Rhinosporidium has any special resemblance to the Sarcosporidia, though this is the only group Neosporidia hitherto known to occur in man. Another feature which appears to differentiate *Rhinosporidium* from the typical Neosporidia is the manner in which spores are formed successively in the pansporoblasts. In this point it recalls the peculiar but still unnamed parasites described by Schewiakoff in Cyclopidae."

J. H. Ashworth and A. L. Turner, in 1923, described a case similar to Dr. Seeber's and Major O'Kinealy's. Their patient, a native of the State of Cochin, on the southwest coast of India, who resided in this community until the age of 20. They stated that a number of cases of rhinosporidium have come from this district. This patient complained of nasal discomfort and found on inspecting his throat in front of a mirror that on deep inspiration a growth became visible below the edge of the soft palate. On subsequent occasions he found it necessary to push the mass upwards with his finger before he could swallow with comfort. It was removed through the mouth but recurred and was removed again eight or nine months later. In 1912, in Madras, he suffered from obstruction and nose bleeds from the left side of his nose. In 1913, he came to Edinburg to study medicine. In 1914, Turner saw him for the first time and removed a pinkish colored mass from the left side of his nose. This was repeated

during 1914 and 1915. During 1917, 1918 and 1920 further removal of the growth was carried out by means of the nasal snare. Associated with the presence of the growth there was a constant troublesome viscid secretion which when examined was found to contain a large number of sporangias and spores. In 1921 both nostrils contained spores and polyp masses were present in each nostril.

"As the patient had now completed his medical studies, he expressed a desire that some more radical treatment should be carried out. A skiagraph was made of the accessory sinuses, and the opinion was formed that these cavities were free from disease, but the lower part of the nasal chambers, especially the left, was distinctly shadowed. As he was anxious to avoid scarring of the face, the Rouge operation was decided upon. This was performed on May 12, 1921.

The detachment and elevation of the upper lip and alae nasi gave good access to the nasal cavities, both of which contained masses of growth which bled freely and prevented observation of their exact attachment. When the main portions had been removed, it was then found that the site of origin was mainly the mucous membrane covering the nasal septum on both sides. Fig. 2, Plate 1, illustrates the resected part of the septum, and although the appearance suggests that the whole of the infected area of mucous membrane has not been removed, great care was taken to dissect every trace of the growth from the cut edge of the septum, after cleansing with hydrogen peroxide. Both ethmoidal regions appeared to be normal; the interior of the left maxillary sinus was inspected, but the cavity was empty. With the exception of a small area of mucous membrane immediately below and anterior to the left middle turbinate, which appeared suspicious, and which consequently was removed, no evidence of growth could be detected other than that already described upon the septum. The soft parts were replaced and sutured."

In this country Jonathan Wright, in January, 1903, quoted a letter accompanying some slides holding sections of tissue from E. C. Ellet of Memphis, Tenn., being

"sections of three nasal tumors removed from a young man of twenty years of age, a few days ago. The clinical history is as follows: In March, 1897, I saw him first, and removed with a snare a papillomatous looking growth which sprang from the lower anterior part of the right side of the septum. In November, 1898, I removed a smaller growth of similar appearance from the anterior end of the right inferior turbinate body. At that time the septum was healthy. In March, 1902, he had some further obstruction in the same side, when some tissue was partially removed by a general practitioner. On December 13, 1902, I found a large mass of a similar appearance to the others springing from the old site on the septum, and removed it. Then a similar small growth was seen further back on the turbinate and this was removed. There was also what looked like a spur, low down and springing from the septum. On touching this it was found to be movable. The body of it was round and

smooth, and it looked and moved like a spur that had had a submucous fracture through its base. This was removed. The patient passed from observation in a few days. I had all three pieces cut, and I enclose a copy of the pathologist's report. None of the previously removed growths were examined. They seemed to be benign, warty growths. The result of the examination was such a surprise to the pathologist and to me that I am going to impose on you to the extent of asking you to take a look at the sections and see if you can throw any light on the subject."

Wright stated that there appeared to be two stages of the cysts, the paler granular stage and the sporemorulae stage. It must be borne in mind that the cysts at different stages contain different sized sporules, varying slightly among themselves, but almost uniform in size for each cyst.

In the granular stage the cysts are farther from the epithelium and in a more unfavorable location due to the encroaching fibrous new connective tissue. The walls of the cyst are of horny or chitinous material, with a thin inner protoplasmia or generative layer. In this stage there are no sporemorulae to be seen within the cyst, but granules which have a dark chromatin speck at one pole and a clear zone at the opposite pole.

In the sporemorulae stage the cyst lies just beneath, or in the hyperplastic epithelium. The chitinous capsule is disintegrating and being replaced with a fibrous envelope. The inner protoplasmic or generative layer has become thicker and the sporules have increased in size. No granules are apparent; only the sporemorulae. The cyst at this stage is ripe and ruptures on the surface of the epithelium, disgorging the sporemorulae, or pansporoblasts, into the nasal secretions.

Mary C. Lincoln and Stella M. Gardner of Chicago reported a case in a resident of the United States in the "Archives of Pathology," July, 1929. They stated that on October 4, 1928, they received from M. C. Van de Venter of Keokuk, Iowa, a tissue for histologic examination, marked "tumor of the anterior superior portion of the nasal septum." The history of their case follows:

"A man, aged 40, was born in Carthage, Ill., and had lived there until he was about 17, when he spent three years in Chicago. At some time later, he lived one year in Oklahoma. In 1925 he spent nine months in Florida. He had never been outside of the United States.

Thirty years before he came to Dr. Van de Venter, an operation was performed on the nose, and at that time the septum was perforated. The

patient had no further trouble with the nose until twenty-two years later. Then he commenced to have a discharge and occasional bleeding.

About October 20, 1928, Dr. Van de Venter removed the tumor which is described in the present paper. He stated that the patient was in good general health, that his blood gave a negative Wassermann reaction, and that healing was rapid after the operation. The patient was seen about six weeks after the operation, and there was no sign of recurrence."

Microscopic examination showed the tissue to be infected with *Rhinosporidium seeberi*."

MURPHY BLDG.

CONGENITAL ATRESIA OR OBSTRUCTION OF THE
NASAL AIR PASSAGES.*

V. P. BLAIR, M. D.,

ST. LOUIS.

In the congenital deformities encountered at or near the junction of the frontal and maxillary tubercles, we have run across a number of details, the morphology of which is not entirely explained by our own limited and standardized conception of the embryology of this region.

For the sake of simplifying the presentation, the cited cases are roughly divided into (1) those with atresia at the anterior nares, (2) atresia at the posterior nares, (3) obstruction by some malformation within the passages, (4) total absence of nasal passages, and (5) pharyngeal narrowing due to backward displacement of the maxillæ. We have observed but one case of complete absence of nasal fossæ and nose. We have encountered an obstructing hydrocele within the nose, and it is not improbable that the obstructing nasopharyngeal polyp of early childhood is also congenital in its origin.

All the cases of atresia at the anterior nares seemed to be lacking the ala on that side, though in some the nostril was indicated by a dimple alongside the columella, Figs. 1 and 5. In Figs. 2, 3 and 6 there was no trace of this. In most of these there is a scar or a slight bony tubercle just above the inner canthus, and in all there is a downward turn to the inner canthus on the affected side. Fig. 6 may be an explanation of these cases. The tube hanging from above the inner canthus rather suggested by its contour and make-up that it might represent all of the structures of the missing half of the external nose except the bone, while the lack of patency at the lower end of the lacrimal sac suggests that possibly it also represented the nasal duct. Fig. 1 showed no supra-canthal mark of a possible one time attachment of a

*Read before the American Laryngological Association, June 15, 1931.

similar nasal tube, nor any symptoms suggesting obstruction of the duct. In all of these unilateral anterior nasal obstructions there was a nasal cavity on that side, though in one (Fig. 6) it seemed to be blind or obstructed posteriorly. Cases of this sort were dealt with differently according to age and individual variations as illustrated under Figs. 1, 2, 3, 5 and 6.

Most of the cases of atresia at the posterior nares that we have seen were unilateral, and associated with some patency of the facial clefts. In all, the nasal mucosa ended in a blind pouch posteriorly, and there was an anterior wall of mucosa and submucosa to the nasopharynx. The normal approach for correction of the obstruction here would seem to be by splitting the mucoperiosteum of the palate and velum, as shown under Fig. 7. Where it has accompanied unilateral cleft of the palate, the obstruction was on the side opposite the cleft and could be dealt with at the time of the repair of the palate. We once overlooked one of these and think it a good rule to verify the patency of the posterior naris on the uncleft side by passing a small soft catheter.

Obstructions occurring within the nasal passages have been widely divergent in character, and in most of them there has been a slight or wide bifurcation, or a partial reduplication of the nose, Figs. 8, 9 and 10, but the majority of bifid noses which we have seen were not obstructed more than comes from misshapen septa or turbinates. In Fig. 8, the obstruction may have been due primarily to an overdevelopment of the maxillary sinuses which crowded the nasal floor upward and the lateral walls inward, or the abnormal size of these sinuses may have been secondary to some condition within the nose itself. In Fig. 9, the obstruction was due to incomplete descent of the premaxilla and prolabium, cause or effect of the bifurcation—who knows? In Fig. 10, the nasal passages were impinged upon by what seemed to consist chiefly of a widened mass of reduplicated vertical plate of the vomer and quadrilateral cartilage. This might be the result of dichotomy as expounded by Bland-Sutton, or the rather complete reduplication of the nose on one side might be more in the line of abortive twin formation. In Figs. 11, 12 and 13, there was a total absence of any essential nasal structure or of any structure derived from the nose or its lining.



C.

B.

A.



D.



E.



F.



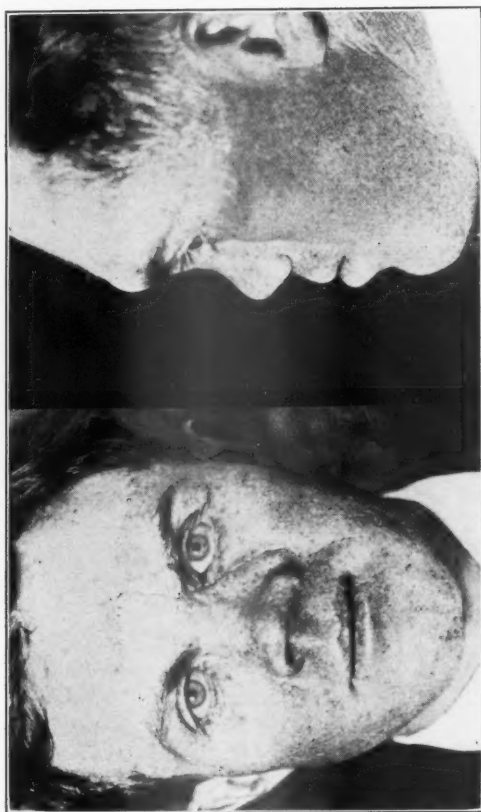
G.

Fig. 1 (Case 1).—A shows child apparently minus an outer nore but with a dimple to suggest the position of the nostril. While it lacked an ala and vestibule on that side, above this the nose appeared to be of normal fullness. This latter was true of course, for the nostril was covered by mucosa and covered with face tissue. The operation was planned on that side. B and C show the correction obtained by operation that also gave him an apparently free breathing space on that side. D, E, F and G show the plan of operation that was completed at one step. The opposite eye is seen to be congenitally deformed.





Fig. 2 (Case 2).—A and B are front and side views, preoperative, of a man 24 years of age with congenital absence of the left half of the nose and retrusion of the left half of the face. Note the shortness of the nose, left nasal fossa behind this, and also blockage of the nasal duct. Note the shortness of the nose, retraction of base, downward inclination of internal canthus with bony tubercle above it.



D.

C.

Fig. 3 (Case 2).—C and D. Taken 17 months later show the final result after the obstructed left ear had been removed and the internal canthus put in a more normal position.



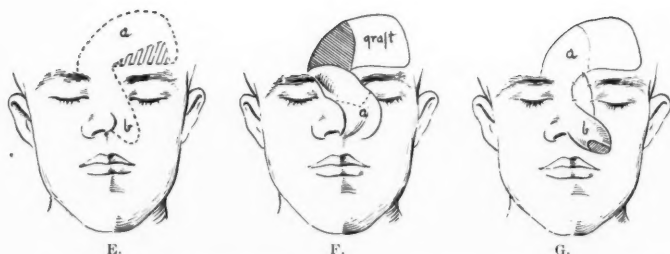


Fig. 4 (Case 2).—E. Flaps outlined on forehead and cheek. Flap *a* was raised from the forehead, and *b* from the cheek, both being sutured back in their beds and allowed to season for six weeks.

F. Flap *b* has been raised again from the cheek to form the external surface of the new left side, while the *a* flap has been brought down to line the left side and to repair the defect in the cheek. As shown here it hides flap *b*.

G. The pedicle of flap *a* has been cut and returned to the forehead while the outer border of the reconstructed side of the nose and ala remains free. The free border was later freshened and implanted into its proper place on the cheek, which you will observe was onto the surface of the transplanted part of flap *a*. Before doing this, an attempt was made to establish the patency of the anterior nares of that side.

In complete congenital cleft of the lip and alveolar process there may be very marked obstruction of the breathing passages; in a single cleft it is partially due to the tip of the nose and columella and lower border of the quadrilateral cartilage shifting away from the cleft and the body of the septum bending with its convexity toward the cleft side. This is not apparent in early infancy but develops within a few years in any older child that has had a poor adjustment or none at all of the ala and floor of the nostril. When the columella and ala are brought into their proper relation, the obstruction may become greater and remains so until corrected by operation. In complete double cleft of the lip and alveolar process, the septum and premaxilla remain midline, but the latter is displaced forward and the mass of the septum is abnormally wide just behind its attachment. When such a cleft is repaired without making special provision to establish a nasal breathing space, there may result an obstruction which will require relief. In both the single and double complete clefts there is usually enough essential tissue to reconstruct a floor of the nostril that will give breathing space, but quite a bit of this is usually displaced downward onto what appears to be the lip, and, in the repair, unless this is identified and restored to its proper habitat, greater obstruction may result. Some impingement may



Fig. 5 (Case 3).—Shows child 5 years old of rather the same type as Figures 2 and 3. Operation on the nose will be postponed until he attains his approximate growth. However, owing to the suppurative in the blocked lacrimal sac the latter was removed and the deformity of the internal canthus was more or less successfully corrected by a flap switching operation. *B* shows the child after operation.



Fig. 9 (Case 4).—A shows an old case which possibly throws some light on the morphology of the preceding or at least of the preceding cases. On the left attached above and to the right of the nose is a hollow mucous-lined cystic mass of the size of the thumb. The child's face is reminded one of the ala and was circular in form. A thin, patent, fluid looked from its open end which was thought to be tears. In the correction an attempt was made to open this tube longitudinally and use it to make the right side of the nose, including ala and vestibule. This did not work out completely but part of it was used to make the right side of the nose with the idea of doing further work on the child when it approached maturity. During the course of this work it was necessary to open the cyst and establish drainage into the pharynx of a blind mucous-lined cavity which probably represented the nasal fossa.

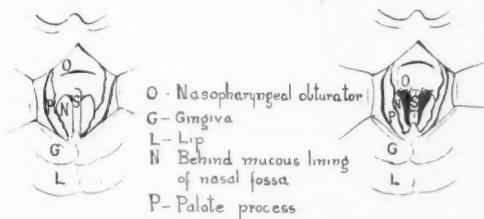
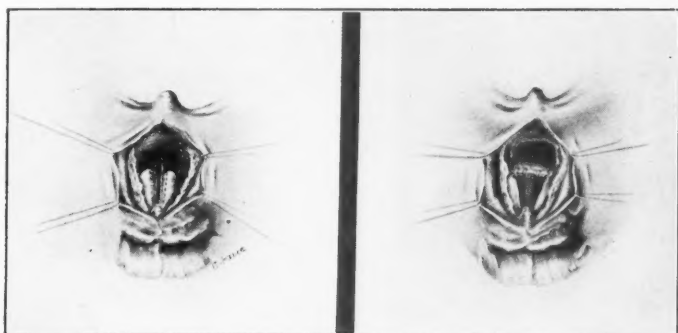


Fig. 7 (Case 5).—A is a drawing made from a sketch done at an operation for the relief of congenital bilateral obstruction of the nose at the posterior nares. This stage was attained by first dividing, then raising up, the mucoperiosteum from the underlying palate processes, and retracting each half with silk sutures weighted with artery forceps. The major part of the palate process has been removed as well as that of the cartilage and bone of the nasal septum. A mass of fibrous connective tissue which lay between the blind posterior ends of the nasal fossae and the nasopharyngeal obturator has also been removed. The obturator consisted of mucous membrane covering the posterior surface of a fibrous curtain.

B. The two mucous pouches of the nasal fossae were incised along the dotted line shown in A and the two median free edges were sutured together below the stump of the nasal septum. The nasopharyngeal obturator was converted into a tongue shaped flap by an incision indicated by dotted line in A. This flap was sutured anteriorly and laterally to the mucosa of the nasal fossae, thus completing a continuous passage into the nasopharynx, mucous lined on its upper and lateral surfaces. The operation was completed by suturing the mucoperiosteum in the midline.

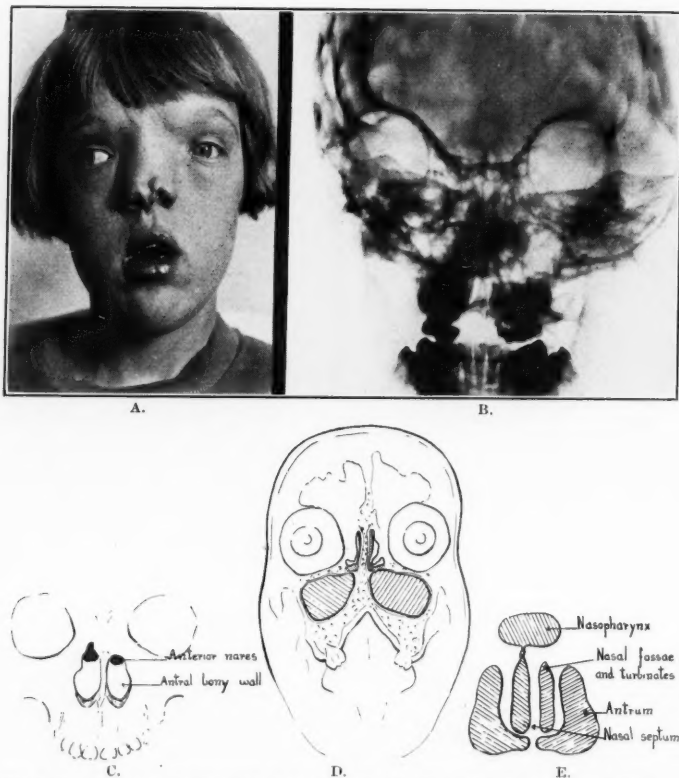


Fig. 8 (Case 6).—A shows photograph of an 8-year-old girl with a bifid nose and characteristic breadth between the eyes which has been described as a hypertelorism. She had no breathing space in the nose. The vestibules were closed posteriorly by a mucous-covered bony wall with pin-hole communication with the deeper fossae high up. Correction consisted in raising the upper lip and associated face tissues through an incision in the upper fornx, down to the bone and raising the periosteum, along with the other tissues. In removing the thin underlying bony wall, it was found that there were two immense maxillary sinuses which approximated each other in the midline in front, and also below the floor of the nose. See C and D. The essential intranasal structures were crowded together into a small space which is shown in B as the dark mass in the center of the nasal region.

B. Anteroposterior X-ray which, until it could be interpreted in the light of the operative findings, threw little light on the case except that the paranasal sinuses were present.

C. Semi-diagrammatic representation of the findings on raising the lip and cheeks from the maxillary bones. The anterior nares are shown obstructed by the anterior wall of the antrum with a small communication above on each side that led into the nasal fossae.

D is an imaginary transverse section through the skull based on the operative findings. It shows the turbinate bones and septum proper crowded up between the orbits, and the space for the lower portion of the nasal fossae obliterated by the antra meeting in the midplane but separated by a bony septum. The palate was "V" shaped.

E is an imaginary coronal section made just below the anterior openings of the nasal fossae (see C) showing the relation of the maxillary antra to the nasal fossae and showing also that the left nasal fossa had no demonstrable communication with the nasopharynx. Posteriorly, it was thought that there was a very small communication between the right nasal fossa and nasopharynx.

With biting forceps the whole of the obstructing mass, including the anterior wall of the maxillary sinus within the anterior nares, the median walls of the two antra which were the outer walls of the nasal fossae in the lower part, the floor of the nasal fossae and the median septum down to the palate process, and the nasopharyngeal obturator were removed, converting the whole into one large, mostly mucous-lined cavity opening anteriorly into the nostrils and posteriorly into the pharynx. It had been intended to cover the raw bony surfaces with split skin grafts, but on account of the condition of the child, these surfaces were dressed with light iodoform gauze packs, and the remaining part of the repair postponed. The child made a good postoperative recovery.



A.



B.



C.

Fig. 9 (Case 7).—A shows a child with a blind nose and a median cleft of the upper lip, the nasal passages being rather completely obstructed by a mass lying behind the rounded prominence that can be seen between the two halves of the nose. At operation this was found to be a partially descended premaxillary mass containing two central incisors.
B. Drawing showing the full thickness of the lips, the wall of the nose above, and skirting the median sulcus of the nose below, the nasal septum and columella through which a pyramidal mass of skin, bone, cartilage and mucosa, with its apex at the base of the nose, was removed. The soft tissues of the face were undermined until they could be approximated in the midline. The papillum on the left side was removed.
C' is a drawing made from post mortem photograph, the child having failed to survive the operation more than a few hours. This operation was done under immediate post war conditions.



B.

A.

Fig. 10 (Case 8).—A patient with a partial reduplication of the nose who was sent to us at the age of four months, after the cleft of the lip had been repaired. It was treated along the general plan described under Fig. 9, but with the aid of hypothermia during operation and blood transfusion afterward, the child went along without any evidence of shock. B shows a picture of the child three years later; probably has a very flat bridge which will be benefited by a cartilage transplant later.

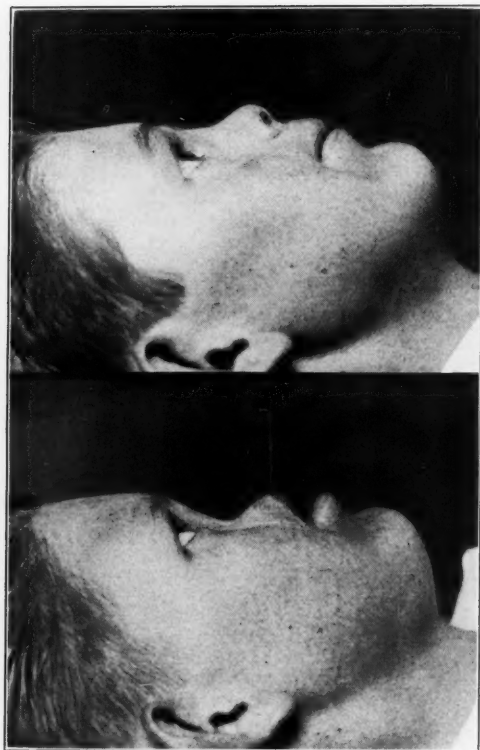


Fig. 11 (Case 9).—*A* shows a side view of a boy who was born with no evidence of any nasal structure. *B* shows the external correction which was done by means of a flap from the forehead after excising the lacrimal sacs, letting down the upper lip, establishing a skin-lined breathing tube by dissecting through a mass of bone that lay just above the palate and establishing connection with the nasopharynx.

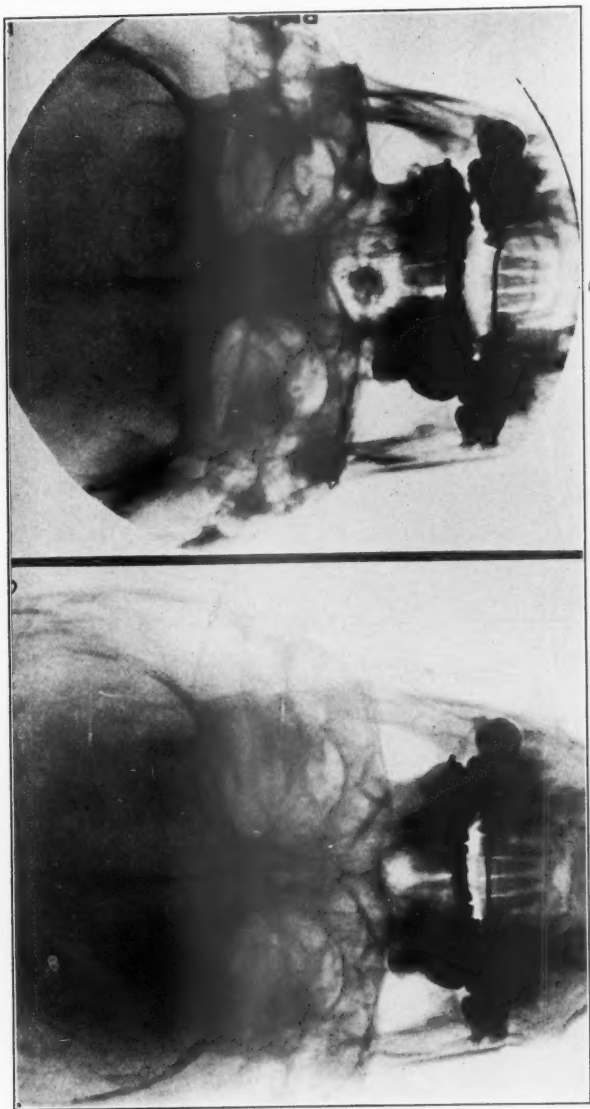
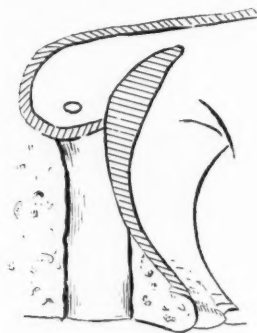


Fig. 12 (Case 9).—*C* is an anteroposterior X-ray taken before the operation which shows the complete absence of nasal sinuses or a nasal passage. *D* shows the same case after chiseling in a nasal passage. The dark spot in the new nasal passage is iodoform gauze. *C* and *D* are of different weights, the better to study the region of the sinuses.



0 — Nasopharyngeal obturator



F.

E.

Fig. 13 (Case 9).—E is a diagrammatic drawing showing the new nasal passage which was dissected through a solid bony mass back to the mucous-covered nasopharyngeal obturator. This was done by drawing a large split skin graft, raw surface out, and drawing this into the new bony tube and through the nasopharynx and through a cross incision in the nasopharyngeal obturator. This backward way of introducing the pack that carried the graft drew the triangular flaps of the nasopharyngeal obturator into the bony tube, raw surface out, and gave the bone where they could heal with little chance of the obturator becoming re-established. The contamination of the bone was avoided because of the backward way of introducing the graft. The patient who shows no signs of active infection at the time of operation, and who does not develop some infection, and who does not expect practically 100 per cent healing in of the grafts if the raw surfaces are cleanly cut and proper pressure is maintained.

In F the new bony canal is quite discernible.

occur, even with the most careful conservation. Also, in either the double or single cleft a tooth may erupt or remain imbedded within or about the floor that may cause some obstruction.

We have seen a few babies who had a combination of, possibly, some backward displacement of the face on the base of the skull, marked retraction of the chin, and an anteroposterior flattening of the pharynx, accompanied by a cleft of the velum. This latter is a fortunate accident or essential, whichever may be. In one of these we repaired the palate at the end of the first year, and then had to put a rubber tube through the mouth into the pharynx to let the child breathe comfortably. The tube, or something else, caused the sutured halves of the velum to separate and then all was well again. This anatomic condition seems to correct itself with growth. In one baby that required tube feeding for the first nine months, the relations gradually improved until at two years it had a rather normal appearance, and closure of the palate at this time gave it no inconvenience. It has been our observation that a young baby is restless, loses sleep and weight, and does bad generally if it has not free nasal breathing.

In accepting this rather loose collection for presentation before the association, the secretary of the American Laryngological Association requested that plans of correction be included, and therefore they are outlined in the legends.

METROPOLITAN BLDG.

LXXXI.

SCIENTIFIC ASPECTS OF THE WORK OF THE AMERICAN
FEDERATION OF ORGANIZATIONS FOR
THE HARD OF HEARING.*

EDMUND PRINCE FOWLER, M. D.,

NEW YORK.

A constant thought of every member of the Federation of Organizations for the Hard of Hearing is the protection of others, especially children, from deafness. Our members need no outside reminder of their duty. They have the problems of deafness constantly thrust upon them; they realize that the co-operation of the otologists is imperative if their desires for prevention research are to be satisfied.

For many more or less obvious reasons, the prevention of deafness, aside from the surgical standpoint, is practically a virgin field for research, in spite of the fact that even today many underlying etiologic factors are generally known and that a few alleviatory, curative and preventive measures may be clinically carried out.

The grouping of many persons afflicted with deafness (as in the leagues of the hard of hearing) at once suggests possibilities otherwise unavailable for investigating the causes of subnormal functioning of the hearing mechanisms.

The New York League for the Hard of Hearing should be credited with pioneer efforts in the scientific approach to the problem of the prevention of deafness along certain lines:

Every member is requested to answer a questionnaire on deafness in his family.

Every member is urged to submit a brief personal history of his ear trouble and to have an audiometric examination of his hearing. A large number of these histories have been collected.

*Presented before the Annual Meeting of the American Otological Society at Briarcliff Lodge, June 18-20, 1931.

1. As you all probably know, beginning five or six years ago, with the co-operation of the Acoustic Research Laboratories of the American Bell Telephone Company, a phonograph audiometer was constructed and surveys of school children were begun. In many cities every school child is now yearly examined by the phonograph audiometer. With no other instrument have such surveys been practical.

2. Based upon these surveys, supplemented by the 2A audiometer tests of all found deafened, it has been estimated that there are three million school children with subnormal hearing in the United States, and that only about one-quarter of this number realize their disability. Many times this number of adults must also be deafened, and their number should be determined. These facts alone show the importance of studying the problem. Surveys could be made of large selected and unselected groups of adults in colleges, homes for the aged, general hospitals, insurance applicants and life extension institutions, etc.

We are carrying on surveys in a general hospital and have made a careful survey and otologic examination of one large hospital for the tuberculous.

3. Acceptance of the League's conception of the deafened problem and the necessity for periodic examinations, though gratifying, will accomplish little unless something can be done for those who are found potentially or actually deafened, or potentially or actually sufferers from any kind of ear disease. (Slides showing proportion of deafness in one school.)*

4. The ordinary otologic clinic, either because of too many patients or insufficient energy (or both), gives little or scant attention to deafness as such. Its energies are expended mainly upon the surgical cases, and so as a part of my service at Manhattan Eye, Ear and Throat Hospital, a clinic was established especially for the children found affected in the League's school hearing surveys. It was thought that, though such a clinic could accomplish little quantitatively, it might stimulate in our own and other cities other leagues and other otologists to initiate and carry on efforts along the same line—that is, the better examination, care

*Fowler, E. P.: Deafness in School Children. Archives of Otolaryngology, July, 1927.

and study of diseases of the ear causing deafness. (There have been six such clinics.)

CLINIC STATISTICS.

	Manhattan	Brooklyn
Interviews	155	
Examinations	201	34
Visits for treatment.....	1197	34
X-rays	231	6
Chemical analysis	239	2
Special treatment	49	
Operations	8	
Ear	1	
Mastoid	3	
Throat, T. and A.....	4	
Referred to other clinics.....	13	4

AUDIOGRAMS.

At League	507
At Manhattan Hospital.....	160
At Medical Center.....	165
At Seton Hospital.....	278
At schools	403
Children	1059
Adults	454
Total audiograms	1513
Visitors to clinic.....	57
Addresses	10
Articles	4
Broadcasts	3

The clinical statistics in New York City for the past year are as shown in the table.

The scientific work is divided into two parts:

1. Clinical.
2. Laboratory.

Clinical procedures have been carried out along the following lines. Every patient is subjected to a complete examination as set forth upon the history chart. (Fig. 1.) Care is taken to ask every question indicated and as to family and personal history, not only about the ear trouble but concerning all ailments possibly related to deafness. Plus marks and other signs are used to indicate all abnormalities and their degree. Other arbitrary symbols

are employed to save space and for easier visualization and comparison.

Otoscopy by the naked eye and by the magnifying pneumatic speculum, using a daylight lamp, determines the exact appearance of the membranæ tensa and flacida for each ear, also at subsequent examinations. This is sketched upon the chart. The degree of movability of both of these is indicated by $>$ or $<$ marks. If any pinkish glow is apparent through the drum, with or without the aid of the pneumatic speculum, it is noted. Incidentally the test described before this society last year has proved of value in the diagnosis of otosclerosis, namely, excentuating the pinkish glow upon the promontory by pressing the drum inward and thus thinning it and bringing it nearer to the promontory.

Vertigo and tinnitus are investigated and a fistula test applied to every suppurating ear. The caloric and rotation tests are done when indicated, using twenty-two diopter lenses before the patient's eyes to prevent fixation and to magnify the movements.

The nose and nasopharynx are examined, and the patency of the eustachian tubes determined by Politzerization with the head vertical. If any obstruction is suspected, the inflation is repeated with the head bent sharply toward first one side and then the other. This will determine the efficacy of the tubal abductors and if successful will exclude stenosis of the middle and upper portions of the tube, because stretching the neck muscles gives a better purchase for the abductor tubæ muscles to open the lower end of the tube and has no effect elsewhere upon the tubal patency.

Audiometric determination of the hearing capacity is made by air conduction at all frequencies, and by bone conduction up to 4000 V. D. Where indicated, a masking sound is used in the ear not being tested.

The lower tone limit and the Rinne tests have been discarded as misleading and unnecessary, because the actual losses in sensation units by air and by bone conduction give more accurate and understandable measurements, which are comparable at all frequencies.

The Galton whistle is blown before the open ear, and before the ear closed by tightly pressing the tragus. A normal ear will

79.11. Mucus Closed N/L-OBSTRUCTIVE DEAFNESS

Externa
I. G.
Cellulitis
Foreign Body
Atresia Canal
Otosclerosis
Date + O. M. N. S. + Date

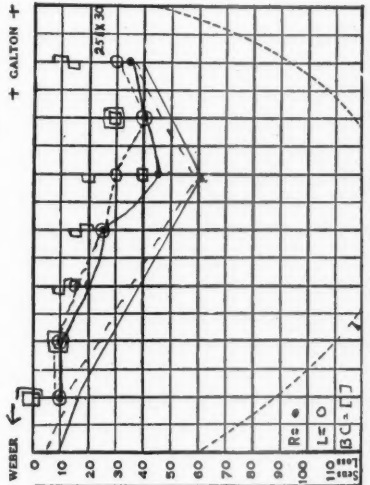
Ac. +
Chr. +
Hid.
Exac.
O. M. S.
Ac.
Ree.
Cb.
HHL
Exac.
Polyp. Granulations
Cholesteatoma
Complications

+ NERVE DEAFNESS +

Cortical
Cerebral
Nerve
Cochlea
Sp. Ganglia
Vestibule
Cochlea
Tonic
+ Specific ? +
Tuberculosis

Abriles 117 141
SPECIFIC TREAT
1ST RETEST

SEE OVER



WEEKS	0	10	20	30	40	50	60	70	80	90	100
R	100	80	60	40	20	10	10	10	10	10	10
L	100	80	60	40	20	10	10	10	10	10	10
FORMS	A.C.										
B.C.											

+ WASSERMANN
K + +
A + + + +
C + + + +
K =

Police
Whisper
Ankles Tests
3X11.29 X-RAY MASTOID
Pan. Sol. Inf. Type Inf. Sol. Pus.

Size
> Cortex
- Zygomata
> Septa
> Lumen
DN Sinus BK
O Absorb Areas O
> Canals
> Petrous

TR. X-RAY SINUSES TR.
+ Front +
+ Max. + + +
+ Eth. + + +
E E A A E E E
> + Sphen. + +
- Sella -

Lobes Hilus CHEST Hilus Lobes
+ + + + P. B. T. +
Inf.
Ca. Glands + + + +
Sketion
Asplen. T. B.

Incontinentia
Furiosus Oculi
Fidele
Spinal Tap

easily hear the sound though it be closed. Many deafened ears will not hear it and so may be then classed as really deficient for the higher tones. This is a method for better evaluating the hearing capacity for the Galton whistle. Calibrated tuning forks are used only by the alternate placement method, the only method by which the A. C. and the B. C. may both be measured by the same instrument in comparable periods of decrement of the fork.

The only satisfactory standard blow has been found to be "the maximum" blow. This is sure to activate the fork so that within a fraction of a second it will have begun its logarithmic decrement at its greatest magnitude of vibration.

The faint and medium whisper, the faint, medium, loud and shouted voice, are used to determine the approximate S. U. loss for the spoken voice. If these are not heard at 15" it means that there is a loss of at least 30, 45, 60, 75, 90 and 100 S. U., respectively.

For an emergency masking effect, blowing directly into the external auditory canal has been found very satisfactory if properly done. Blowing into the bulb of a stethoscope tightly fitted into the patient's ear often serves as a useful improvisation of a noise apparatus.

There is great need for a noise apparatus which does not communicate so much vibration through and around the head to the ear being tested that accurate measurement of its hearing by air and by bone is impossible. It is believed that by using an air douche with the nozzle well within the external auditory canal one may obviate the unsatisfactory features of the present methods of masking. Experiments indicate that such an apparatus may be manufactured. The secret of its efficacy lies in the fact that the noise is created near the drum membrane (not outside the head).

Before and after every simple, radical or modified radical mastoidectomy careful audiometric tests of the hearing are made to determine the exact effect of the various operative measures upon the hearing capacity.

Stereoscopic roentgenograms of the mastoids and nasal sinuses coincident with repeated audiometric tests have given convincing

proof of the necessity of always considering the nose as a possible and important factor in the etiology of ear disease. It has been found that in the great majority of our children there is more than a slight involvement of the nasal sinuses,* and that changes in sinus pathology very regularly accompany recurrent nonsuppurative and especially suppurative otitis media. The treatment of the nose is often far more imperative than treatment of the ear directly, and treatment in the clinic alone will often fail to cure purulent recurrent otitis media unless it is supplemented by regular home measures. It is believed that herein lies an often neglected opportunity for not only the cure but the prevention of deafness. The chest is examined roentgenologically and otherwise if indicated.

Through the co-operation of Dr. Andrew A. Eggston and Dr. Frederick M. Law, it has been possible to study the correlation between the clinical picture and the pathology shown by roentgenograms and the tissues removed immediately thereafter at operations upon the sinuses and mastoids. These studies account for otherwise inexplicable discrepancies between the clinical and X-ray pictures of sinus and mastoid disease. Blood counts, differentials and chemistry are repeated at intervals.

Before this society, I reported last year the results of calcium, phosphorus and cholesterol determinations. Further tests give no reason to change the conclusions then stated—i. e., there is no greater variation in the calcium and phosphorus content of the blood in otosclerotics than in many other classes of ear disease.

The blood Wassermann is done in every case, and when found positive every member of the family is urged to submit to it, and also to be examined otologically. Several interesting incidents prove that this is worth while.

I will show you the results of a few of these family examinations. Notice that not in every case where the father or mother are positive does the child show a positive Wassermann or deficient hearing, but that other evidence often points to possible or probable future ear disease and deafness.

*Deafness and Coincident Variations in Nasal and Aural Pathology. E. P. F., Arch. Otolaryngology, January, 1930.

Family Groups.

[illegible]

The intracutaneous tuberculin reaction is noted in every case to determine if any relationship exists between this reaction and other clinical and laboratory findings.

Tuberculin inoculations have been given (as a foreign protein) to eighty-five patients with most gratifying results, not only as to hearing, but especially as to improved health.

The table shows this quite clearly.

FOREIGN PROTEIN TREATMENT.

<i>Otosclerosis:</i>		With	Improved		Without	Improved		Ident.
Age	Cases	F. P.	Hear.	Hlth.	F. P.	Hear.	Hlth.	
1-9	2	0	0	0	2	0	0	..
10-15	5	4	2	3	1	0	0	2
16-20	4	4	0	0	0	0	0	0
21+	21	17	3	9	4	0	0	3
Totals	32	25	5	12	7	0	0	5

Summary—Cases, 32; +F.P., 25; —F.P., 7; Imp. Hr., 1/5; Imp. Hlth., 1/2.

<i>Nerve Deafness:</i>		With	Improved		Without	Improved		Ident.
Age	Cases	F. P.	Hear.	Hlth.	F. P.	Hear.	Hlth.	
1-9	19	3	2	2	16	2	1	2
10-15	18	8	1	1	10	3	5	1
16-20	10	6	2	2	4	0	2	2
21+	26	16	2	2	10	1	4	2
Totals	73	33	7	7	40	6	12	7

Summary—Cases, 73. +F. P., 33; Imp. Hr., 1/5; Imp. Hlth., 1/5.
—F. P., 40; Imp. Hr., 1/7; Imp. Hlth., 1/4.

<i>O. M. N. S.</i>		With	Improved		Without	Improved		Ident.
Age	Cases	F. P.	Hear.	Hlth.	F. P.	Hear.	Hlth.	
1-9	13	0	0	0	13	4	2	2
10-15	11	3	1	1	8	1	0	0
16-20	7	2	0	0	5	0	0	0
21+	1	0	0	0	1	0	0	0
Totals	32	5	1	1	27	5	2	2

Summary—Cases, 32. +F. P., 5; Imp. Hr., 1/5; Imp. Hlth., 1/5. —F. P.
Imp. Hr., 1/5+; Imp. Hlth., 1/12+.

FOREIGN PROTEIN TREATMENT—CONTINUED.

O. M. S. Ch.	With	Improved	Without	Improved				
Age	F. P.	Hear.	Hlth.	F. P.	Hear.	Hlth.	Ident.	
1-9	9	2	2	2	7	0	0	2
10-15	14	2	0	0	12	4	4	4
16-20	7	3	1	1	4	0	0	0
21+	10	3	1	1	7	0	0	1
Totals	40	10	4	4	30	4	4	7

Summary—Cases, 40. +F. P., 10; Imp. Hr., 2/5; Imp. Hlth., 2/5. —F. P., 30; Imp. Hr., 1/8; Imp. Hlth., 1/8.

Considerable experimental work has been done with the functional tests for hearing and the static labyrinth reactions.

The co-operation of the Ophthalmologic Department has made it possible to obtain valuable observations of the fundus of the eye, especially as an aid in determining the presence or absence of a jugular sinus thrombosis and its site. It is believed that the dilatation of the retinal veins occasioned by pressure upon the jugular vein is a safe and efficient aid for diagnosing sinus thrombosis, and that it should be used more often for this purpose, and not only as is customary for determining upon which side a probable sinus thrombosis is located.

The Tobey-Ayer manometric spinal tap is used only if a spinal tap is indicated for other reasons than for diagnosis or to differentiate a right from a left sided thrombosis.

A definite diagnosis is attempted in every instance, using the scheme printed on the history chart. Every case is cross referenced. Each disease is tabulated in four age groups (1-9, 10-15, 16-21, 21-), all inclusive. The slide shows one age group under otosclerosis and two under nerve deafness.* The clinical and laboratory findings are indicated above, so that it is easy to compare different examinations of the same case and one case with another.

Treatment at the clinic is always aided by home measures when indicated, and it is believed that many of our children have benefited largely because home treatment was insisted upon.

*Method of charting is similar to that shown in Fig. 2 (slide 6).

The pathologic research has been done mainly at the College of Physicians and Surgeons, with the co-operation of Professor Coakley and the supervision and aid of Professor Joebling. The animal experiments, especially those on vitamin deficiency diets, have been under the direction of Dr. Zukker.

The study of temporal bones has been directly under the supervision of my son, Dr. Edmund P. Fowler, Jr. The autopsy material was obtained from the Medical Center group of hospitals and from experimental animals.

The patients in the wards have been examined and tested with the audiometer in order to co-ordinate the findings during life with those found after death.

Besides the postmortem study of the temporal bone, the nasal sinuses and related pathology found elsewhere in the body have also been studied.

Ninety-four pairs of temporal bones have been obtained (to May 1, 1931). Twenty-seven pairs have been serially sectioned and tracer series have been stained with the customary hematoxylin-eosin, while a few sections have been treated with special stains.

Several interesting cases have been found, not least of which are two cases of unilateral otosclerosis unsuspected before death. These are mentioned because they illustrate the fact that in supposedly normal people we may find the key to the cause of certain types of deafness, as otosclerosis.

In the clinic the work has required the extra aid of one nurse technician (Miss Pless) and my secretary. For this work volunteer helpers might be obtainable (more easily, may be, than otologists).

I believe that every league for the hard of hearing should co-operate with the otologists to establish and carry on a clinic for the treatment and study of deafness and diseases of the ear.

This account of our clinical and laboratory activities naturally includes many personal ideas. Other otologists will have other and better ideas, and so the problems may be attacked from all sides if we do our share and carry on.

140 EAST 54TH STREET.

LXXXII.

COMMENTS ON THE CHANGES OCCURRING IN
MEDICAL PRACTICE: PRESIDENT'S ADDRESS.*

CHESTER H. BOWERS, M. D.,

LOS ANGELES.

The Pacific Coast is honored this year in having the members of the American Board of Otolaryngology as its guests. This marks their fourth visit to the coast, and we realize the great personal sacrifice that this entails upon these busy men. We also wish to express our gratitude to them for the help and inspiration their visit affords and to welcome our many distinguished guests. We are grateful to them for making this long journey. We welcome our guests in truly Western manner. You are a part of the association and we hope that you may enjoy the papers presented and also take part in the discussion which follows.

An annual address by your presiding officer is prosaic at best, and when one realizes the men who have preceded, it is difficult to assume that one could give much which could even savor of originality. Added to this must be the realization of the fact that we have an excellent scientific program, where time for discussions will prove to be a valuable asset. For this reason I feel that brevity on my part will afford more time for this feature of our meeting.

Everyone will agree that human life has value, not only sentimental but actual economic value. The view that men, women and children should be looked upon as community assets is rapidly spreading throughout the civilized world. Learned books have been written to show that human life in the aggregate is the community's greatest asset, far transcending material possessions of all kinds.

*Delivered at the meeting of the Pacific Coast Oto-Ophthalmological Society, Los Angeles, California, May 28, 1931.

Our specialty is an integral part of the whole domain of medicine and surgery. We are not isolated but must of necessity be affected by changes which are about us on every hand. It is concerning this so-called new era I wish to speak. The whole world seems to be in a state of seething chaos. Economic upheavals are in progress. Labor and capital are still in a death grapple, but out of it all we must realize that medicine and surgery are broadening, that scientific and clinical advancements have not been curtailed.

Prophylactic otolaryngology is still in its infancy, a vast undiscovered field. It is a lamentable fact that medical science has not as yet found any preventive or cure for the most frequent of human diseases, namely, colds and related disorders. Only in the last decade, in fact, has this group of diseases been seriously studied and credit for initiation of fundamental researches on the subject should go chiefly to the United States Public Health Service. Thanks to these investigations, we have at present reliable data not only on the prevalence of these infections but on their geographical distribution as well as their frequency in different ages and at various seasons of the year.

As a cause of disability among industrial concerns this group of diseases takes first place. These diseases account for 47 per cent of the time lost and 54 per cent of absences due to illness. Obviously the financial loss to industry is tremendous. With the average daily wage of only \$2.00 a day, the cost of respiratory illnesses during the period of one year must closely approximate \$64,000,000 among 10,000,000 employees. Likely the loss is even greater. There is, therefore, an urgent need for study of the factors which cause these variations.

Due to the excellent care given to the children by the pediatricist, certainly the number of children requiring tonsillectomies is greatly on the decrease. Scarlet fever has been extremely mild for many years, and the complication of scarlet fever, serious otitis media, is very much lessened. We have immunizing agents for diphtheria, scarlet fever and a convalescent serum for measles. No antiserum for whooping cough has ever been developed, and the vaccine that we have is not considered very valuable, either in prevention or treatment by some of the leading physicians in

this country. Yet this disease, which mothers frequently regard with indifference, killed almost 6,000 children under five years of age in 1928. Diabetes, due to the discovery of insulin, is on the wane. And so on down the line we have seen definite advancement in the last decade.

In the presence of all of this change, it is inevitable that some of our customs must change. We have seen much progress in our scientific attitude, and yet we generally fail to take advantage of many advancements which would go far toward making the medical meetings a success. For example, members of the medical societies often travel as many as five or six thousand miles to attend a meeting. They lose a week or ten days of valuable time from their offices, and are asked to listen to papers in small, crowded, poorly ventilated rooms, in uncomfortable chairs; to strain to hear the essays, when it is entirely possible to provide proper accommodation and for a small cost to secure instruments for the amplification which would add tremendously to the sum total of what is retained by the audience.

We are ever alert in the new discoveries and advancements but prefer shutting our eyes to some of the extrinsic factors which are affecting our profession today and will affect it more in the near future.

I refer to the tremendous growth in favor of state medicine and health insurance, and the tendency toward the same mass production in health matters as is seen in the industrial corporations of our country. The practice of medicine, in addition to scientific knowledge, will always be a matter of personality, and you cannot standardize personality. Articles of a critical nature are appearing with increasing frequency in both medical and lay periodicals. Many of these are based upon individual instances of apparent injustice due to poor quality of professional service rendered, and fees which place an excessively heavy strain upon the individual. While these are individual matters, the profession as a whole is being held accountable. It has been frequently stated that the indigent and wealthy receive adequate medical and hospital care, but the middle class is suffering because of the increasing cost of scientific medical care, hospitalization and nursing care. Time will not permit a detailed analysis of the situation, but

from the surgeon's standpoint it would often appear that hospitalization frequently consumes the entire reasonable allotment for an operation, leaving little or nothing for professional services. Nevertheless, the fact remains that in the eyes of the public the medical profession is responsible for most of the difficulties inherent in the present situation, and there is a growing sentiment in favor of government action to solve the problem. Such an action will inevitably tend toward State medicine, and many careful students are convinced that unless we as a profession evolve a feasible solution one will be thrust upon us by political action.

We are told that our fees are responsible for the high cost of sickness and that we must reform or be reformed. As a matter of fact, we know that such is not the case; that most of our house calls, for example, are for less than taxicab service for the same distance, and that the people of the United States pay as much annually for candy as for medical services. To take one large fee which an isolated individual may receive and charge it against the profession is not unlike saying that income tax paid by men with million dollar incomes is characteristic of tax in general.

To avoid unfair comparison, we must educate the public to understand the facts. The rank and file of our profession continue to give service to their lay fellows and without ostentation carry on in their effort to ameliorate and cure diseases without even thinking that, in all probability, they will never be able, in a lifetime, to save the sum advanced for their education. Conditions have progressed to the point that it is doubtful if one of us can encourage his children to study medicine unless they are independent financially. Can we continue to stay within our temple, feeling secure in our heritage and ignoring the duty to succeeding generations, content in our own little sphere and not wishing to be disturbed?

Since the world war, on every hand we realize the prevalence and influence of propaganda; we recognize the good and the bad. The public is interested as never before in all matters of scientific interest. The polar discoveries, the Einstein theory, the experiments in light and electricity, and so on. They would be equally

interested in health matters if only given an opportunity. Witness the large editions of books treating with the lives of doctors and the romance of medical explorations.

I have been told by many people that they look forward with eagerness to the advertisements in certain magazines relative to medical progress and care of the body. In the various metabolic clinics, where health lectures are the vogue, the attendance is astonishing, and yet as an organization we continue to ignore this condition. I have been watching in a certain weekly magazine which devotes several columns to aeronautics, education, religion, the arts and medicine, to note how little of real medical interest appears in those columns. The discussions which appear are often such as reflect but poorly the real work of the profession; rather the subjects covered are the dope evil or some reference to liquor prescriptions.

The cultured atmosphere of our colleges has been invaded by a utilitarian curriculum. The department of economics is called upon for advice by the corporations, and the papers contain much from these sources. Our universities are expecting their professors to lecture to the public on every phase of life; the physicist realizes the interest and keeps the public informed, not only by radio but through the press. The end result of all this is that endowments are increased and greater progress is made.

Much good has come from insurance companies who, because of selfish motives, wish to prolong life, as they have instructed a small portion of the public as to the advances made in medicine, the cancer research, the toxin antitoxin treatment, and the value of periodic examinations.

It is obvious that we as individuals can do nothing, but why cannot our medical societies and our medical schools in a serious manner undertake the problem? Our universities should train men for this purpose; our medical faculties should create and take advantage of every opportunity to inform the public. Since writing this I find that Harvard University has started a series of talks on Sunday afternoon for the lay public. We should encourage our own members to write intelligent articles which would appear in lay magazines to replace the erroneous, unscientific

pabulum which often finds its way into the press. We should inform the public through radio and publications of the fundamentals of health, the romance of medicine, the newer discoveries and problems, omitting any reference to cults and isms.

If we attack this problem in the same earnest spirit that has characterized our scientific efforts, we will not fail but will create an interest in health which will be reflected in the increased length of life, stimulate interest in the most important factor affecting the human race and preserve for succeeding generations a heritage better than the one which we received, a profession of which it has been an honor to be a member from the earliest times.

To wield that power, the greatest, after all, possessed by man—the power to banish suffering and ward off the approach of death itself.

1136 WEST SIXTH ST.

LXXXIII.

MICROSCOPIC OBSERVATIONS OF THE
EUSTACHIAN TUBE.*

DOROTHY WOLFF, M. A.,

ST. LOUIS.

In view of the interest in the microscopic anatomy of the eustachian tube, bilateral series of vertical sections are presented. The sections extend from the mastoid antrum forward to the pharyngeal end of the eustachian tube.

CASE HISTORY.

Autopsy No. 3920. The case is that of a hydrocephalic five-months-old white female child of a mother aged 18 and a father aged 24 years. This was the only child and the only pregnancy. The child entered the hospital with a history of crossed eyes and vomiting, the onset of the trouble having been three weeks previous to the admission date. The vomiting occurred five or ten minutes after feeding and was of projectile character. The child cried continuously. No previous illness had occurred and no history of trauma could be elicited. No drowsiness had been noted by the mother. The family physician had said the difficulty was in the feeding, but no improvement followed the medicine administered by him. The child was treated by a chiropractor with no improvement.

Physical examination revealed a hydrocephalic infant, fat but slightly flabby, whose head fell forward. The circumference of the head was 50 cms. The fontanelle was wide, tense and bulging. Scalp vessels were moderately dilated. A soft purpuric mass was on the right frontal region. The ears were negative. (The patient was not seen by the Otology Service.) Pharynx and nose were negative. The neck showed enlarged cervical glands. There was no evidence of deformity or paralysis. All reflexes were exaggerated.

*From the Department of Otolaryngology, Washington University School of Medicine, St. Louis, Mo.

No clonus. No rigidity. No Kernig. Eyes showed strabismus. Pupils were regular, equal and sluggishly reacting to light. Discs were blurred (fleeting vision). Eyegrounds showed optic nerve atrophy, primary, complete. Large atrophic choroidal spots in the right, probably the result of prenatal choroidal exudate. Red blood corpuscles 4,000,000, white blood corpuscles 26,700, neutrophils 20 per cent, eosinophiles 5 per cent, lymphocytes 60 per cent, large mononuclears 11 per cent, myelocytes 4 per cent. Tuberculin test negative. Wassermann negative. Lumbar puncture: spinal fluid showed anthochromia with marked increase in pressure. One thousand cells per cu. mm., mostly red blood cells, mostly crenated. On combined ventricular and spinal puncture, when the patient was flat, pressure on the fontanelle caused a rise in both manometers. Crying also caused a rise in both manometers. A diagnosis of communicating hydrocephalus was made. The temperature ranged between 36.8 and 38. The lungs were negative except for a few fine rales at left base. The spleen was large, hard and firm. The child remained in the hospital two weeks and weight fluctuated, with a slight gain. There was practically no vomiting, and stools were normal. X-ray examination of the skull showed an increase in the size of the entire skull with a thinning throughout. The appearance was that of hydrocephalus. Combined puncture showed a communicating type of hydrocephalus. The patient was operated on, but, in attempting to remove a block, a large venous sinus was opened which bled profusely, necessitating termination of the operation. The child was given a transfusion immediately, but before very much blood was run into the veins, expired. At autopsy, nose, mouth and ears were reported negative. Some aspirated material was present in the bronchi. The mesenteric lymph nodes were prominent. The brain collapsed upon removal. The third ventricle was widely dilated and a blockage (type not stated) of the aqueduct of Sylvius was reported.

MICROSCOPIC OBSERVATIONS OF THE TEMPORAL BONES.

Microscopic observations of the temporal bones reveal an acute suppurative mastoid infection on the right with much pus throughout the middle ear cavity, and on the left an early stage of the

process quite obviously advancing by way of the eustachian tube. The photographs show comparable areas of the two ears in the regions of the malleo-incudal joint, and various areas in the tube as it advances toward the pharynx. Numerous eosinophilic myelocytes are present in both ears. Although no actual count has been attempted they appear much more numerous in the bone marrow than in other infants of this age. They occur both in the free pus in the middle ear and mastoid cavity and in the submucosa. On the left side large clusters of these may be observed around arteriolar walls in the submucosa of the eustachian tube. The pink staining granules of the cells are frequently seen as if trailing along behind the eccentric nucleus. Lehrfeld recently reported the presence of eosinophiles in conjunctival discharge one hour after instilling an allergic agent. Proetz reported cases of allergy in the middle and internal ear observed clinically. At the suggestion of H. L. Alexander, the family history of the patient was investigated by L. W. Dean. No allergic conditions were discovered.

(a) Right Ear.—On the right a rather diffuse polymorphonuclear infiltration is present throughout the submucosa of the cavity. The folds of the mucous membrane surrounding the malleo-incudal joint are edematous and infiltrated. Shrapnel's membrane is heavily infiltrated as is the whole of the tympanic membrane on each side of the fibrous layer. The mucosa is almost all sloughed off, as is the epidermis over Shrapnel's membrane. This is also the case, intermittently, elsewhere over the drum membrane. Prussak's pouch is filled with pus. There is evidence of cellular detritus in the external canal. The secondary tympanic membrane is also invaded and the niche of the round window is completely filled with pus.

Although the bony facial canal is open at the level of the stapes and heavily infiltrated mucosa covers the aperture, the infiltration has not invaded the facial canal. "Dehiscence" of the facial canal has been observed by the author in ten cases, ranging in ages from stillborn to five years. These cases show perfectly normal bone along the facial canal. The condition appears to be a normal one for the infant, the bony canal not having completely formed. It may also occur in the adult without evidence of necrosis. Ormerod states that facial paralysis is much commoner

in children than in adults and that it appears to be due to pressure from granulation tissue. The anatomic condition probably explains the pathologic possibilities.

The ampullæ of the horizontal and superior canals are quite normal; that of the posterior is slightly infiltrated by small mononuclears.

The cochlea shows a degenerated organ of Corti. (The autopsy was two hours after death.) There is no accumulation of pus cells in the labyrinthine cavities, but there are some desquamated cells in the endolymphatic duct and ductus cochlearis. A slight lymphocytic infiltration is present along the perineural sheath of the eighth nerve and in the basal turn of the ganglion. The ganglionic cells are pale-staining, indicating a necrotic condition, all the rest of the cells staining exceptionally well. The wall of the cochlear artery is tremendously thickened. The dura lining the internal auditory meatus is edematous and the venous capillaries are engorged with polymorphonuclear leucocytes and eosinophiles.

The condition in the eustachian tube indicates a somewhat more chronic condition than that in the middle ear proper and in the antrum. The infiltration is diffused but accentuated around the blood vessels. Eosinophiles and eosinophilic myelocytes are present in the submucosa. Small blood vessels are numerous and fatty infiltration is found on the medial wall of the right tube—but not of the left.

(b) Left Ear.—The pathologic condition on the left side is more recent than that on the right, and there is evidence that the route of infection has been by way of the eustachian tube. While the antrum on this side is involved, it is not to the same degree as on the right. The tympanic membrane on the left is quite free from infiltration. A cushion of mesenchyme, quite normal in appearance, is still present in the niche of the round window. This does not appear to be so located as to cause obstruction. Its presence on this side and its absence on the right is an interesting developmental phenomenon. The tube proper on this side as well as the middle ear mucous membrane shows a much more patchy type of infiltration. There is no fatty infiltration on the

left side as on the right. In the lumen of the tube just anterior to the tip of the cochlea is a much heavier purulent mass than is seen in the same region of the opposite ear or than appears either above or below this region on the left side. The arteries of the tube on this side are congested with blood, whereas they are quite empty on the opposite side.

INTERESTING ANATOMIC FEATURES OBSERVED.

The peculiar anatomic location and trend of the eustachian tube give rise to a confusion of descriptive terms. Two sets of orientation denominations which would ordinarily be considered mutually exclusive of each other, are employed in the literature. The American anatomists, Gray, Morris (D. Lewis) and Maximow, speak of the "lateral" and "medial" walls of the eustachian tube, as do most of the German writers. The clinical investigators, Kerrison, Politzer, Pittmann, etc., on the other hand, refer to the same areas as "anterior" and "posterior," respectively. This point must be borne in mind when interpreting the serial sections and the descriptions.

The bony wall of the eustachian tube is quite irregular in contour when seen in cross section. At several points it presents interstices leading into the carotid canal. These can scarcely be called "dehiscences," as that term bears a pathologic connotation, and here the bone is perfectly normal. In progressing toward the pharynx the roof (see Fig. 6) is the first part of the tube to appear cartilaginous. The posterior or median wall gives the characteristic hook-shape (Fig. 7) seen in the textbook figures. Spalteholz describes the lumen of the tube as being triangular. This specimen, with the mucous membrane intact, does not show it thus. Stripped of its mucous membrane it would be triangular. But with the membrane intact, the lumen toward the tympanic end appears as a blunt V and toward the pharyngeal end as a more or less straight crevice with many tributaries.

The median (posterior) wall of the tube has much thicker submucosa, while the lateral (anterior) wall and roof may have the basement membrane directly adherent to the periosteum. As Bridgett has observed, the roof of the tube bears a more cuboidal

and nonciliated epithelium, while the floor and sides are definitely ciliated columnar (Fig. 5). In this specimen the ciliated columnar cells frequently occur in tufts, such as are seen in the bulla of the cat and lower animals. Toward the pharyngeal end the epithelium of the roof also becomes ciliated columnar but continues to have no submucosa. The floor of the tube is thrown into numerous folds, which gradually assume the character of enteric crypts and may be traced to mucous glands lying in the submucosa on the median side. We find no mucous glands on the lateral side in this case, although they have been observed in other cases in our collection. Numerous goblet cells occur near the pharyngeal orifice.

At the level of the isthmus of the tube the lymph channels become less tubular in shape and tend to assume widened sinusoid spaces. In Fig. 8 may be seen a lymphoid nodule, described as tubæ tonsil (Gerlach), or noduli lymphatici tubarii (Spalteholtz).

A branch of Jacobson's nerve (a branch of the glossopharyngeal) may be seen running down along the floor of the tube (Fig. 4), toward the medial or posterior wall. Toward the pharyngeal end it divides into two branches. Approximately half way up the tube a branch of the caroticotympanic plexus enters the tube (Fig. 4) and runs toward the middle ear along the medial (posterior) wall. Each of these two nerves is accompanied by an arteriole and two or more veinules. The nerves are found to anastomose at the promontory and to be redistributed there.

SUMMARY.

1. A case of infantile hydrocephalus is reviewed in which the significant postmortem changes reported are blockage in the aqueduct, acute suppurative otitis and mastoiditis.
2. The right side is much more heavily involved than the left.
3. The submucosa of the right tube shows a more chronic pathologic condition than does the submucosa of the right middle ear.
4. Extension to the left ear is obviously via the eustachian tube, both directly through the lumen and along the submucosa.
5. The following anatomic observations are made:

(a) Apertures may occur in the bony wall of the carotid and facial canals without necessarily having an extension of the pathologic changes through these interstices.

(b) The lymph channels widen out into spaces in the region of the isthmus of the tube.

(c) The medial wall is thicker than the lateral. Submucous glands occur only on the medial wall of the tube in this case.

(d) The change in type of the epithelium in the roof and floor of the tube is noted, as is the tufted character of this epithelium and the presence of goblet cells on the floor of the tube near the pharynx.

(e) Two nerves were observed along the posterior (medial) wall, one near the floor of the tube, the other along the upper medial wall. This latter enters the tube above the isthmus.

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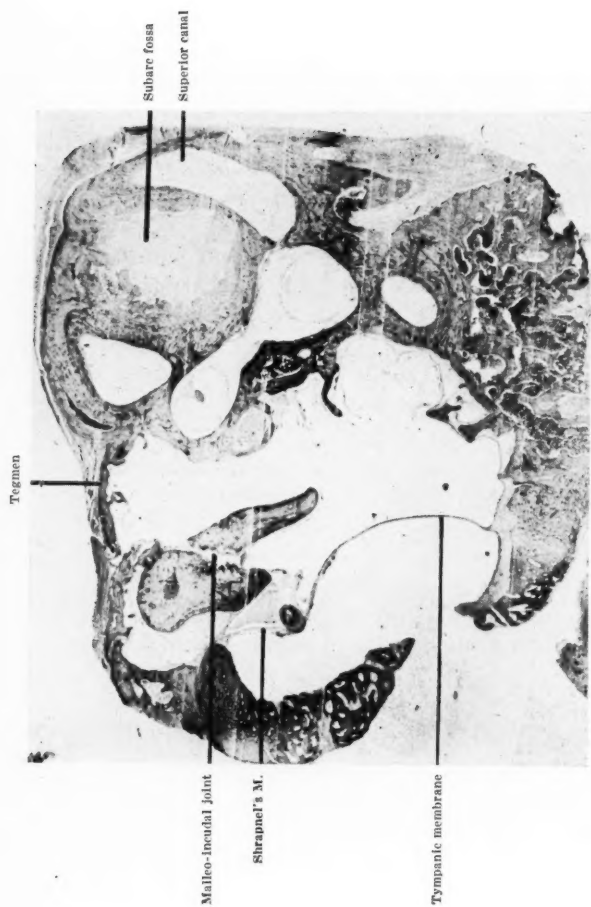


Fig. 1. Left ear showing relatively little pus except in Prussak's pouch.
(All illustrations to this paper are photomicrographs.)



Fig. 2. Right ear showing a great deal of pus throughout the middle ear cavity.



Fig. 3. Left ear with pus filling tube. (Unfortunately the photograph has reversed the section. Anatomically this appears as a right ear.)



Fig. 4. Detail of right eustachian tube showing greatly thickened medial (posterior) wall.

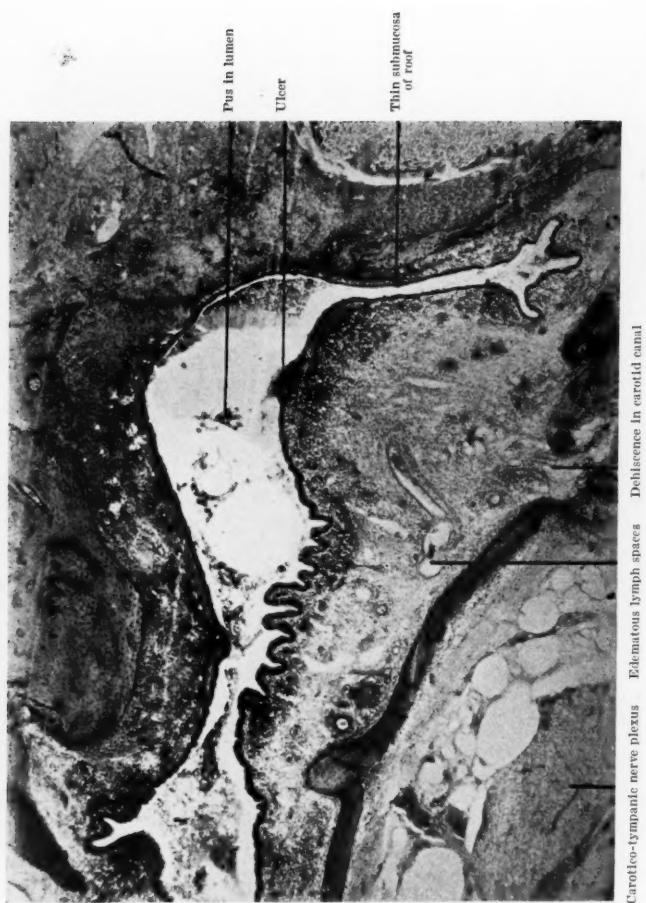
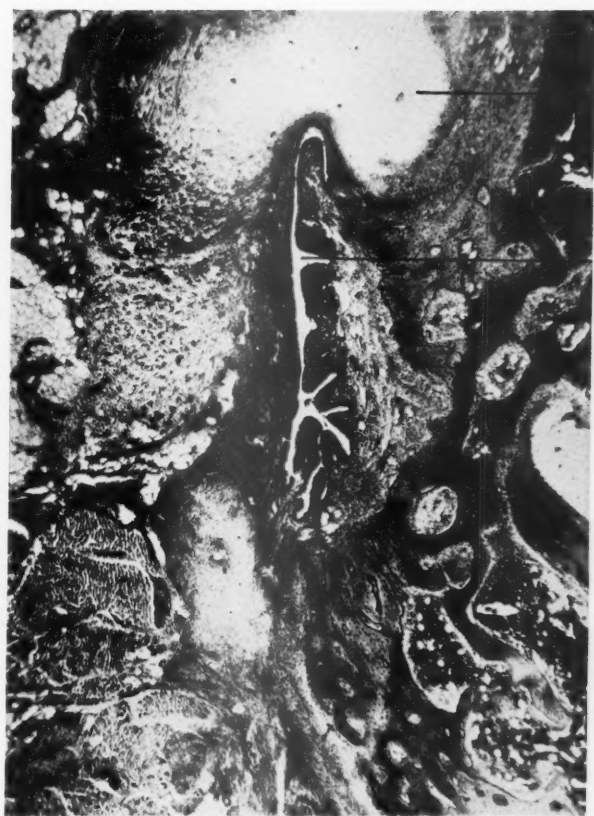


Fig. 5. Detail showing change in character of epithelium as it proceeds from roof to floor.



Cartilage

Lumen
of E. T.

Fig. 6. Detail of eustachian tube as it appears just below the isthmus, where only the roof is cartilaginous.

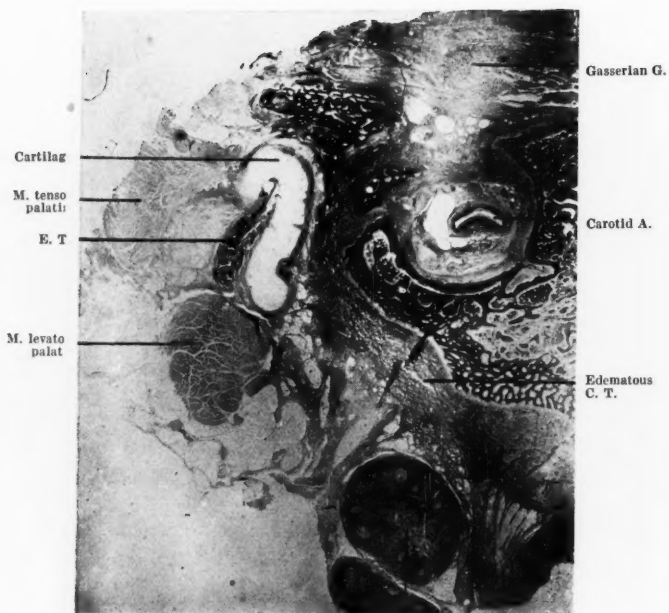


Fig. 7. Left eustachian tube as it appears near the pharyngeal orifice.

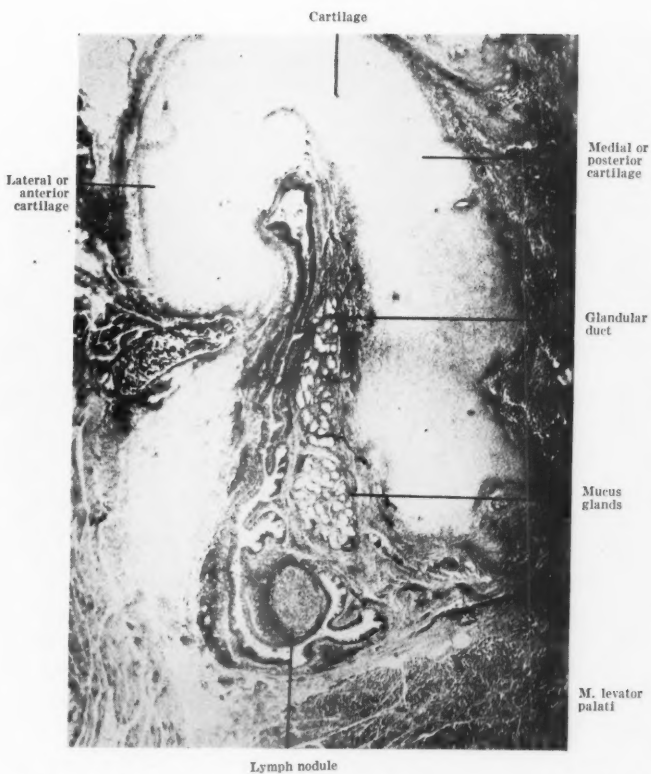


Fig. 8. Detail of eustachian tube, near the pharyngeal end. (Left.)
Goblet cells may be seen in the mucosa near the lymph nodule.

LXXXIV.

OTOLARYNGOLOGIC ASPECTS OF COMMERCIAL AVIATION.*

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While the visual function is of paramount importance to the aviator, he must also possess good breathing space, good hearing and an excellent sense of balance. A full supply of air is necessary to the flyer, and in the thinned air of high altitudes his oxygenation is impaired, with danger to the accuracy of his responses in control of his ship. It is true that at such heights there is a long distance in which control of the plane may be recovered; but even a temporary loss of control may lead to fatal difficulties. This is especially true in flying high over the transcontinental routes across the Rocky Mountains and the Andes. Also, distinct effort is needed in expiration during flight, because of the high air pressure flowing past the plane at good speeds, due to the slip stream thrown back by the propeller as well as to the rapid movement of the plane. These matters are, of course, covered fully in the general medical examination, in the tests of breathing capacity.

For these reasons the otolaryngologic examiner is required to look very carefully into the matter of mechanical obstructions to free breathing. Septal deviations or thickenings; turbinal hypertrophies; nasal polyps and the underlying accessory sinus involvement; nasopharyngeal fibromata; adenoids; hypertrophied tonsils where there is a history of repeated severe attacks of inflammation; paralysis or stenosis of the larynx; nasal, pharyngeal or tracheal ozena with obstructive crust formation—all these conditions, if not easily remediable, require attention from the student flyer and must be done away with before he can be passed

*From the Symposium on Aviation Medicine, presented before the American Academy of Ophthalmology and Otolaryngology, French Lick, Indiana, September 15, 1931.

to the limited commercial and transport grade. In general, he must have at least four-fifths of the normal breathing space.

Septal perforation invites attention to the venereal history. Active syphilis and tuberculosis are causes for rejection. Any apparently syphilitic lesion, from the mucous patch to the old cicatrix, should invite serologic investigation; and chronic ulcerative processes, suggestive of lupus or other tubercular lesion, indicate bacterial inquiry. Such persons, however, rarely present themselves for examination. Where old tertiary scars are found, positive rejection occurs. The department takes no chances on late lesions of the nervous system.

Occasionally cases of trench mouth, dental caries or severe pyorrhea require attention because of the danger of involvement of the tonsils or of the maxillary antra, with the possibility of bronchial changes. People who fly are likely to smoke a good deal off duty, and occasionally a reduction in nicotin will fix up a bad chronic bronchitis.

Hay fever of the pollen type is no bar to aviation; quite the reverse is true, for the upper air is relatively clear of irritating dusts. Nasal obstruction and asthma due to food and animal product allergies may occasionally require investigation.

Bad tonsils need to come out because exposure in open or bad weather flying is likely to stir up attacks.

Obviously also, the presence of foci of infection, such as apical abscesses, purulent sinusitis and tonsillar suppuration threatens recurrent "colds" as well as generalized febrile attacks with distant manifestations of trouble. Also, any malignant manifestation, and such deformities as severe cleft palate and harelip, are cause for rejection of the applicant. Former operative procedures on the larynx and trachea—as tracheotomy—will cause rejection unless it can be shown that the tracheal caliber is normal.

One who has traveled much by airplane is likely to wonder why good hearing is required. Certainly under present conditions an occupational loss of hearing gradually affects many pilots. Constant noise is one factor, and frequent changes of altitude another, which make for rapid deterioration in susceptible persons.

The student or industrial pilot is required to hear the whispered voice at three feet, and the transport or limited commercial pilot at eight feet, in either ear; the numerals 18, 23 and 66 must be used. The pilot must be able to hear his radio telephone signals and the shouts of his ground crew, copilot or passenger. His eustachian tube must be tested for patency, in the higher grades; temporary occlusion not only causes deafness but may condition severe dizziness during flight, particularly during rapid descent.

Acute or chronic otitis media or mastoiditis, with or without cholesteatoma, or unhealed perforations, are disqualifications; but a trained pilot who has a mastoid operation may return to duty after a waiver of his defect upon recovery. Hearing in the combat services must be normal in both ears. Audiometer tests are not used in civilian examinations and are optional in the combat services.

External ear affections, such as cerumen or epithelial plugs, and eczemas, particularly that caused by the various molds or trichophytions, must be brought to the pilot's attention so that obstruction will not occur.

The vestibular function no longer holds the commanding position in aviation examination which it did during the war. Balance is, of course, constantly disturbed during flight, particularly in the rapid maneuvers of the combat plane. The air is full of currents, not only directional winds, but up and down currents and eddies. It is therefore necessary for the pilot to acquire the "feel of his seat," much as a good rider sits his horse, and he must be trained to interpret sudden movements of his plane, even in civilian flying, and to use the same technic which is constantly required in combat flight, in order to get out of sudden emergencies.

Vision has, as predicted during the war, turned out to be far more important than balance. The blindfold or fog-blinded pilot is helpless, while experiments have demonstrated that a deafmute with dead labyrinths can do pretty well in the air. Except in summer flight in an open cockpit, tactile sense is of little aid in getting the sense of position. Deep muscle sense—the feel of the body in the seat, the movement of the plane about the clothing—are of much importance.

For practical purposes, in commercial examinations it has been found that standing with the eyes closed, on one foot, with the other knee bent at a right angle, for three trials of fifteen seconds each for each foot, gives a very accurate determination of the candidate's steadiness. The turning chair is no longer used. Gait in walking must, of course, be normal, unless the result of a nondisabling fracture. Combat fliers must still take the turning test, with postrotatory nystagmus of normal amplitude and within normal limits—this because of the acrobatic character of much pursuit and combat training. No attention is paid to the minutiae of past pointing and cerebellar orientation in the commercial pilot, and the experience of several years has justified the abandonment of this time-consuming testing. In fact, the expert pilot will not past point normally; he "accommodates" to the unusual motion because of habituation.

Facility in adaptation to rapid position change is obtained in military aviation by the use of the Ruggles "orientator"—a cockpit mounted on universal pivots, and motor controlled so that it may be thrown into any desired maneuver by the pilot or his teacher. The green pilot shows all the classic signs of labyrinthine sensitiveness at first, but speedily overcomes them. The hypersensitive individual, because of added emotional stress under so-called "air sickness," is a worse risk than the person with diminished labyrinthine sensations.

The semicircular canals are not alone in maintaining proper vestibular balance; we must not forget the static effects of the otolith mechanism stressed by Quix, with the pressure upon the cristæ in the utricle and saccule. The Bárány chair tests only the horizontal rotations, while much of the flier's work, especially in combat training or in landing and taking off in fast planes, is more or less in the vertical plane, not laterally at all.

It should not be forgotten that psychic conditions may greatly alter vestibular sensitiveness. Worry, fear, excitement over the outcome of the examination, the aftermath of a "wild party," sexual excess, may interfere decidedly with the showing made, as well as with the pilot's behavior under training. No pilot should be trusted in a plane with his ears buzzing with alcohol, and government regulations are very strict in this regard.

It must not be forgotten that muscular imbalance of the eyes may cause vestibular symptoms under flying conditions—an added reason for care in the eye examination. Other sources of labyrinthine irritation must be eliminated: high blood pressure, excessive smoking, apical abscesses, chronic sinusitis, gall bladder disease, intestinal stasis. Syphilis is a permanent barrier. Locally, the chronic suppurations, especially with high perforations and cholesteatoma, and crusting in the radical mastoid cavity, cause rejection of the applicant.

The American pilot is less exposed in the modern plane than he was a few years ago. He has learned to keep cotton in his ears or to put a powder puff in each side of his helmet. Also, he has a windshield, and in the larger planes a relief pilot; and with improved instruments, stabilizers and the radio telephone his lot is less dangerous and far less trying, emotionally and physically. In general, he has far better equipment to fly with than has the European pilot; his engines are quieter, and his plane is more modern. New planes in Europe appear mostly under military and naval control; the commercial fleets are old, as time goes in aviation.

The requirements of the International Commission for Air Navigation, which controls most of the air traffic over Europe and Asia, are equivalent to those of the Hispanic Air Union. German and Austrian pilots, while not under the Commission, adhere to similar standards, as they are constantly landing in Holland, Czechoslovakia and other countries. Private pilots must hear the whispered voice at one meter, while transport pilots must hear the C forks of 64, 256 and 4096 d. v. at 1 cm. from each ear for the normal period of time. Eustachian tubes must be patent and the vestibular system free from irregularities or abnormalities, and no serious nasal or buccal disease is permitted.

Because of military necessities, European pilots are rather likely to be found in the army or navy reserves. In France the rotating chair is always used, ten turns in twenty seconds, right and left, head 30° forward. In England it is used only as a check up on those likely to go into acrobatic flying. According to the most recent circular of the Royal Air Force, "as a result of the examination of first grade pilots by the Bárány tests, it was found that the

reactions to rotation might be excessive in some individuals and diminished in others, but in neither case did the reactions of the vestibular apparatus seem to indicate an airman's probable flying ability."

The French examination is very thorough for the beginner, but rather perfunctory for the experienced pilot. Blind walking, forward and back, and the Romberg with one heel touching the other toe, are added to the routine turning test. One has the feeling, watching the European examinations, that the possibility of military service lies back of the careful records which are kept at Le Bourget and at the Air Ministry in Whitehall. Similarly patriotic care should actuate any American physician who is charged with such duties.

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LXXXV.

THE PROGNOSTIC SIGNIFICANCE OF SINUSITIS
IN CHILDREN.*

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The practitioner of medicine, like many a worker in less altruistic fields, cannot pursue the even tenor of his way without encountering, from time to time, waves of enthusiasm which center about and emanate from some increased interest in a particular disease entity. This interest arises in the minds of a few choice souls who, as pioneers in all medical progress, first broach the subject matter to their confreres at some meeting, with the hope that the latter may be persuaded to go back into their communities and preach the same gospel. This they proceed to do, and if the idea under discussion be at all readily grasped by the laity it is but a short time before the disease becomes in many respects a popular one, discussed, even to some extent in technical terms by the public, featured by the press, and finally viewed as almost a requisite for social equality. Such a disease some years ago was appendicitis, and the removal of the offending organ was considered as a sort of badge of entrance into the band of the surgically elect.

More recently, in the field of laryngology, the removal of the tonsil has had a vogue beyond all reason, but a vogue which still continues to the present day. The public have become so educated to the idea of tonsil disease in itself and as a cause of unrelated symptoms and to the operation as a cure-all for an almost unlimited variety of complaints that they make their own diagnosis, oftentimes before reaching the laryngologist's office. Not one of us but in clinic or consulting room, on inquiring as to a patient's chief complaint have been greeted with the reply "Tonsils, doctor," with an air of finality that precluded in the patient's mind

*Presented before the American Academy of Ophthalmology and Otolaryngology, French Lick, September 16, 1931.

any further need for inquiring into the symptomatology, leaving only the formal conclusion of the arrangement for the operation.

That such an attitude, with its resultant surgical abuse and unavoidably disappointing results must be combated by sane and level headed practitioners of medicine goes without saying, and already there are signs that, so far as the tonsil question is concerned, the pendulum is beginning to swing less violently—in fact, a little even in the other direction. Particularly the pediatricians are protesting against indiscriminate operation on children until complete physical examination and laboratory studies have eliminated all but the tonsil as the probable source of trouble. One even finds a pediatrician from time to time who rather prides himself on advising tonsillectomy only for the most urgent and indubitable indications.

In the gradual checking of such a public stampede, and once started, no matter for how good a reason, it is hard to check, there rise up from time to time some individuals who for one reason or another are peculiarly able to contribute data which, by virtue of its comprehensiveness and the period of time covered by it, is of the utmost value in throwing much needed light on such problems. Such data must be based on as large a number of patients as possible, and if the advisability of operation is in question, should include patients who have not been operated upon as well as those who have, comparing their symptoms before and afterwards. When such statistics are carefully compiled and compared, we come nearer to being able to estimate the true value of a procedure or the status of a disease entity than in any other way. It was in this manner that the incomparable statistics of Kaiser of Rochester did so much to illuminate the tonsil question and provide more dependable criteria than have heretofore been available.

And now within the last ten years there has appeared for recognition by the public a new disease, sinusitis. The office patient and, to an ever increasing extent, the clinic patient, replies to the interrogation as to the difficulty at hand, "Sinus, doctor." So accurate has the lay diagnosis become that the patient can

differentiate between a pain over the eye which is a "sinus" and a pain over the antrum which is not. From a medical point of view, sinus disease has been brought into prominence as a cause of almost as many different symptom complexes as were once attributed to the tonsil, and in many instances rightly so.

Particularly has this been the case with children. Up to the time when Dean first published his work on sinusitis in children the entire subject had received but meager attention, and one shudders to think of the variety of conditions which were forced to masquerade under some other etiologic title. Gradually the propaganda in regard to sinus disease in children has spread until today it is universally recognized and considered as a diagnostic possibility or excluded as a cause of a considerable number of pediatric conditions. And so the question naturally arises, are we again, as in the case of the tonsil, on the verge of letting our enthusiasms run away with us, of thinking too easily and exclusively of the sinus as the etiologic factor in a variety of symptom complexes, and are we in need of at least pausing for a moment to consider the situation as it exists with respect to children today in the hope of being able at least to assure ourselves that we are on the right course?

Having felt that such a taking account of stock of the sinus question would be of interest and, it is hoped, of some value, I have undertaken to examine the records of some five hundred cases of sinusitis which have been treated at the Children's Hospital in Boston during the past fifteen years. The records include the days when the diagnosis of sinusitis was almost unknown and those in which it appears constantly. They include every form of the disease, from the most acute and fulminating, to the mildest and most chronic. They include every form of treatment, from the most radical surgery to the most inadequate and neglectful medical procedures, for which latter in his earliest days the present head of the laryngologic department takes all the blame. They include, with varying degrees of completeness, an account of the child's subsequent course and his present state of health. For these facts I have been forced to rely, first on the hospital records themselves, which were not always as complete as could be desired; second, on questionnaires sent to the mothers of pa-

tients, and third, on X-ray films taken of children who were brought back to the hospital for this purpose.

This data can in no way compare in completeness and accuracy with the above mentioned statistics of Kaiser on the tonsil question. Nevertheless, covering, as they do, inadequately, the ten-year period during which the subject of sinusitis in children has come into such prominence, they will, I believe, furnish some information which will serve to stabilize the question and enable us to proceed in the treatment of sinusitis with more surety and success.

Information has been sought in the above manner on the following points:

1. The course of the nasal disease since the diagnosis of sinusitis was first made. Has it subsided, either with or without medical treatment; has there been recourse to surgery, and what has been the symptomatic end result from the nasal point of view?

2. The status of the sinus itself, as revealed by an X-ray check-up. What is the relationship between the symptoms and the condition of the sinus as evidenced by this X-ray?

3. Some estimate as to the value of different types of treatment, conservative or radical, in respect to the end results.

The data comprising this survey consists of 480 hospital records, 150 questionnaires returned by mothers of patients and 75 X-ray check-ups of the sinus condition at the present time. It is of course to be regretted that there is not available a questionnaire and an X-ray for every patient. Questionnaires were sent to each patient, but many of them could not be located by mail and many failed to return any reply. Although almost every parent expressed a willingness and desire to have, without expense to them, an X-ray check-up of the child, only a small percentage took the trouble to call up for an appointment. Conclusions, therefore, must be drawn from data of different values, depending on the completeness of the records. Often only portions of the questionnaire were answered, and sometimes an adjoined letter attempted to cover the matter independently. There were surprisingly few returns which contained any reproachful criticisms where treatment had obviously been unsuccessful, and

expressions of appreciation of the interest shown by the questionnaire were numerous.

The extraordinary increase in either the frequency of sinusitis or its consideration as a diagnosis is at once evident on examining these records. In 1918, out of 2,700 patients treated in the otolaryngologic department the diagnosis of sinusitis appears only four times, while in 1930, out of 7,200 cases, it appears 266 times, a percentage ratio of 1 to 23. It is hard to believe that the disease itself is twenty-three times as common as it was twelve years ago, and one must conclude that the increase in discussion of the subject and the greater alertness in making the diagnosis is responsible for these figures. The intervening years show a proportional change in the same direction.

The series included only records in which an X-ray showed definite evidence of involvement of the maxillary antrum in one or both sides. While by no means the infallible sign of sinusitis, it serves as the most satisfactory and constant criterion by which to estimate the existence of this condition. There were, of course, on this basis all varieties and degrees of involvement, ranging from a mild and transient obscuration to an almost complete opacity, and the results of any form of treatment would vary in respect to the degree of pathology present. What I have sought here, however, has been a glimpse of these cases as they come and go, and some generalized information as to the outcome of them under different forms of treatment.

The series includes very few cases under two years of age, sinusitis occurring predominantly among the children between five and ten. Sixty per cent were boys; 34 per cent were girls.

Treatment was carried out either in the hospital wards or in the outpatient department. The former proved invariably far more satisfactory for investigation of these patients and for the securing of satisfactory therapeutic results, but unfortunately it is impossible to hospitalize all these cases and they must be attended in clinics as well as possible. Only in so far as more and more thorough study is made of these patients in hospital wards will progress be made in solving the still perplexing problems surrounding this condition of sinusitis.

The cases have been divided into two main groups, the one comprising the acute, the other the chronic form of sinusitis. By acute is meant the early more or less purulent form of infection, such as is associated with pyogenic organisms, with or without actual pus formation. The chronic type is characterized by a thickening of the lining membrane, with little or no purulent secretion, is often allergic in origin, and often only one factor in a bizarre symptom complex. The acute and chronic forms of sinusitis not infrequently overlap, but nevertheless are in most respects sufficiently distinctive to warrant this subdivision. In this series 30 per cent were included as acute and 70 per cent as chronic sinusitis.

I propose to consider the subject of sinusitis in children principally from the prognostic standpoint. Given a known condition of a sinus and a known form of treatment, what may be anticipated as to the outcome, symptomatically and functionally? Can the initial condition and the treatment of it be correlated with the end result and therefore some conclusions be drawn as to the efficacy of a given treatment in a given type of sinusitis?

Naturally such conclusions will be more dependable in the records in which a questionnaire has been returned as to the present state of the child's health, and still more so in those in which X-ray check-ups add further data. Some conclusions can, however, be drawn from the records which lack this confirmatory information, and these I propose to examine first, supporting them by facts furnished by the other supplementary data.

A. Data obtained from examination of hospital records during the past twelve years, where parents returned no questionnaire and did not return the children for X-ray examination:

In classifying these records I have attempted to estimate the results of the treatment which these children received by dividing them into three groups: those who appeared to have been cured, those who could fairly be said to have improved, and those who did not show any improvement. These estimates were often difficult to arrive at, since the records in many instances did not specifically state the final end result, and much reliance had to be placed on the progress notes and reports from other departments in the hospital. Nevertheless, I believe that some infor-

mation can be derived in this manner which will shed light on the prognosis of sinusitis as it is seen in a large children's hospital.

I shall consider these cases by dividing them into acute sinusitis and chronic sinusitis, and further subdividing them according to whether they received principally medical or surgical treatment. By medical treatment I understand the use of such procedures as nasal irrigations, instillations of various medicinal drops, sprays, suction, inhalations and finally medical procedures carried out in other clinics, such as the anaphylactic and allergic. It is impossible to list these cases separately according to the individual type of medical therapy, but they are classed as a group in contrast to the surgical cases. The treatment which these latter received has been grouped under three main headings: (1) Removal of tonsils and adenoids; (2) antrotomy (intranasal, with or without irrigations); (3) middle turbinectomy, and (4) radical surgery. It must be understood that there were frequent instances where there occurred various combinations of these procedures and also in which medical and surgical treatment were combined, but so far as possible information has been sought on the results of a single form of therapy.

Fig. 1 indicates the situation as it pertains to the cases classified as chronic sinusitis. Medical and surgical therapy are contrasted in respect to their end results and the percentages in each group are recorded. Several interesting facts are brought out in an examination of this chart.

(a) Medical treatment alone resulted in a disappointingly small percentage of cured cases and a surprisingly high number of failures. One can only conclude that some form of surgery or systemic investigation must often be resorted to in order to reach the fundamental difficulty whereby alone a complete cure is attainable. Medical treatment, however, achieved improvement in a considerable number of instances.

(b) Surgical statistics show a fairly satisfactory situation in regard to the removal of tonsils and adenoids, and the partial removal of the middle turbinate. The former has long been advocated as a most important measure in the treatment of sinusitis, and with its high percentage of improvements and total absence

Fig. 1. CHRONIC SINUSITIS.
(GENERAL RECORDS WITHOUT QUESTIONNAIRE.)

Result	Medical Treatment	Surgical Treatment			
		Tonsillec- tomy	Turbinec- tomy	Antrotomy & Irrigation	Radical Surgery
Cured	20%	33%	40%	14%	16%
Improved	42%	66%	50%	75%	65%
Unimproved	38%	1%	10%	11%	19%

of failures thoroughly justifies itself. Turbinectomy has been less in vogue and might even evoke some adverse criticism, but statistically it has been quite successful, presumably because it relieves a chronic congestion around the natural ostium and thereby permits restoration of normal aeration of the sinus. Antrotomy and radical procedures made a good showing only as they served to bring about an improvement, but resulted in only a few cures and only a small number of complete failures.

Fig. 2 indicates the situation in regard to acute sinusitis. Here again medical therapy appears to have been able only to effect a considerable degree of improvement, cures and failures being about equal. From the surgical aspect tonsillectomy appears to have been even more successful than in the chronic cases, as does also antrotomy, a procedure apparently more adapted to acute than chronic cases. Turbinectomy does not figure in the acute statistics. It will be noted that radical surgery proved extraordinarily unsuccessful, not because of any intrinsic deficiency but because it was reserved in almost all instances for the very acute fulminating types of infection in which the risk and probable mortality would be likely to be high in any case. It was in this group that there occurred the six deaths which were found among 480 cases. They all showed the typical picture of swelling of the eye and surrounding orbital tissues and purulent infection of adjacent sinuses such as the ethmoid and frontal. With one ex-

Fig. 2. ACUTE SINUSITIS.
(GENERAL RECORDS WITHOUT QUESTIONNAIRE.)

Result	Medical Treatment	Surgical Treatment		
		Tonsillec- tomy	Antrotomy	Radical Surgery
Cured	23%	72%	57%	30%
Improved	50%	18%	43%	10%
Unimproved	27%	10%	0%	60%

ception these fatal cases were all operated upon in a more or less radical manner, either externally or under the lip, and they all developed some complication such as osteomyelitis, septicemia, meningitis or brain abscess. They were all marked at the onset as of unusual gravity by the external swelling of the soft parts, distinguishing them from the ordinary type of purulent sinusitis. They form a fortunately small group which must be encountered from time to time and which calls for keen judgment and courage in its treatment. My conclusions have been that the longer radical drainage can be withheld with any reasonable safety, the better will be the outcome. Some form of radical surgery will almost certainly have to be undertaken sooner or later, but at the outset every encouragement to nature to wall off the process must be afforded, even in the face of high fever, delirium and intense toxemia. Serious consideration should be given two-stage operations with simple drainage of purulent foci with later radical extirpation of disease. In any case, the mortality will be higher than in other forms of sinusitis.

In reviewing these records, one is impressed with the extraordinary complexity of the situation. In addition to their sinusitis these children often were under treatment for other diseases which may or may not have had a bearing on the sinus condition. This treatment was frequently shifted from one form to another. Their living conditions and diet and habits of work and play

were a constant factor, and the element of allergy was often creeping in to complicate matters. One is left with the impression that unless a child can be isolated and controlled in respect to its activities, its environment and its treatment, sinusitis will remain a difficult problem to solve.

B. Data bases on 150 questionnaires returned by parents. The information asked for was as follows:

1. Have you taken the child for treatment of his nose to any other hospital since your last visit to the Children's Hospital?
2. Has the child had any further trouble with the nose or sinuses since your last visit to the Children's Hospital? Is the child subject to head colds or running nose?
3. Has he had any other illness since then?
4. Has he any trouble at present with his nose?
5. Would you be willing, without expense to yourself, to have the sinuses X-rayed in order that I may check up their condition at present?

I sought information on the question of visits to other hospitals in order to check up the cases which had not been back to us for a considerable period of time. It was somewhat of a pleasant surprise to find that only 12 per cent reported having sought treatment elsewhere, and this did not always indicate dissatisfaction with the treatment received, numerous other reasons, such as "over age" or "leaving the city," being assigned as the explanation. Any condition requiring repeated visits to a clinic must necessarily result in some loss in clientele, no matter what pains are taken to avoid it.

Based on the replies to questions 2 and 4, data has been classified to indicate the results of treatment received by the group of children concerning whom the parents supplied up to date and presumably fairly accurate information. Doubtless inaccuracies have crept in, and the decision as to whether a given case has been cured, improved or unimproved by treatment had at times to be somewhat arbitrary. Nevertheless, this method of arrangement has been pursued as being, on the whole, the most practical and satisfactory. Certainly these figures are far more accurate and conclusive than those obtained from an estimate of the hospital records alone.

Fig. 3 gives the status of medical treatment as contrasted with that of surgical treatment, the latter being a composite figure made up from the various surgical procedures carried out. Here it will be seen that, contrary to the figures obtained from the hospital records, medical therapy has a better record than its surgical rival with more cures and fewer failures. This discrepancy is somewhat hard to explain, but may be due to unavoidable errors associated with drawing conclusions from the records alone.

Fig. 3. RESULTS OF TREATMENT.
(By QUESTIONNAIRE.)

Type of Treatment	Cured	Improved	Unimproved
Medical	44%	17%	39%
Surgical	34%	20%	46%

Fig. 4 is an analysis of the end results according to whether patients were treated medically or surgically. Of the cured cases a preponderant part were given medical therapy. In the improved and unimproved groups the results were about equally divided between the two forms of treatment. The total number of cases treated, either medically or surgically, was almost equal.

Fig. 4.

Result	Surgical Treatment (46% of Total)	Medical Treatment (54% of Total)
Cured	37%	63%
Improved	48%	52%
Unimproved	47%	53%

Fig. 5 is a tabulation of end results according to whether the infection was an acute or chronic one. Medical therapy was apparently much more successful in dealing with the chronic infections than was surgery, and surgery much more potent in curing the acute conditions. This is in accord with general principles in which surgical drainage is consistently effective in dealing with purulent infections. Regarding the cases which failed to improve, it is apparent that these fall to a very great

Fig. 5. END RESULTS BY QUESTIONNAIRE.
(SYMPTOMATIC.)

CURED		
Treatment	Acute	Chronic
Medical	10%	90%
Surgical	45%	55%
IMPROVED		
Treatment	Acute	Chronic
Medical	44%	56%
Surgical	44%	56%
UNIMPROVED		
Treatment	Acute	Chronic
Medical	18%	82%
Surgical	30%	70%

extent among the chronic group and offer a far more stubborn problem than do the acute cases. So far as improvement went, there was not much to choose between either type of treatment.

Fig. 6 is designed to show, regardless of end results, the division of treatment of the acute and chronic cases. As might be expected, a larger percentage of the acute cases were treated surgically and a larger percentage of the chronic cases treated medically.

Fig. 6. TREATMENT.

Type of Case	Medical	Surgical
Acute	39%	61%
Chronic	60%	40%

Fig. 7 is a composite chart of end results, regardless of what form of treatment had been received. The striking fact here is the high percentage of cases which had to be classified as unimproved, a failure in which both medicine and surgery shared about equally. It is in this fact that the greatest problem lies in dealing with sinusitis. In a large number of children local treatment of the sinus will not suffice to eradicate the symptoms, at least for any permanent period. Hence the conclusion is forced

Fig. 7. END RESULTS BY QUESTIONNAIRE.
(SYMPTOMATIC.)

Result	OXO
Cured	39%
Improved	18%
Unimproved	43%

upon us that in many instances we are dealing with some systemic disturbance of which the sinusitis is only one local manifestation. Whether this systemic disturbance is in the nature of a true allergy or whether it is an endocrine dysfunction is beyond the scope of this paper to discuss, but it must assuredly be recognized that sinusitis, and especially chronic sinusitis, is many times far more than a disease of the sinus.

A word in this connection as to asthma. Asthma was a complicating disease, almost always present at the time of the original X-ray investigation, in a surprisingly large number of patients with chronic sinusitis. These patients were most of them being treated in anaphylactic clinics and were referred to the laryngologic clinic for sinus investigation. Efforts to untangle the relationship between the sinusitis and the asthma will, I believe, continue to occupy many of us for some time to come.

Certainly what may fairly be termed routine outpatient treatment will continue to prove unsatisfactory and unproductive of ideal results. Until searching studies are made into the biochemical and physiologic activities of these patients we will fail to understand the underlying factors in this all too prevalent condition.

C. Data obtained through X-ray examinations of the sinuses at varying intervals after the known existence of pathology in these sinuses:

We come now to what may be called the more truly scientific portion of the material studied in this group of cases. Though comprising a regrettably small portion of the total cases, these X-ray check-ups of the condition of the sinus at the present time furnish a more accurate estimate of the local situation than can any statement of the parent or patient. It further affords an opportunity to correlate the symptoms as reported by the questionnaire with the findings as shown by X-ray. In each instance these findings were compared with those noted on the first examination and the progress classified under three headings: (1) No change in the pathology; (2) improvement, and (3) complete return to normal radiability.

Fig. 8 represents the results of these X-ray examinations in respect to this classification. At once there appears the striking

fact that in one-half of these patients there has been no improvement in the condition of the sinus so far as it may be judged by the X-ray. Almost all of the remainder, however, have cleared entirely, a small number only showing improvement.

It so happened that almost all of the cases returning for X-ray examination had been originally classified as chronic. This may possibly be due to the fact that the chronic cases proved so much more resistant to treatment and therefore the parents were more ready to co-operate in any suggestion that might lead to recovery of the patient.

Fig. 8. X-RAY FINDINGS.
(CHECKUP.)

Condition of Sinus	
Clear	41%
Improved	10%
No Improvement	49%

Fig. 9 shows the division of the cases checked by X-ray into those treated medically and those treated surgically. Since a greater proportion of the cases were treated medically than surgically in the entire group (54 per cent medical, 46 per cent surgical), it is apparent from this chart that there was no outstanding advantage in either form of treatment so far as its effect on the X-ray picture went. The two types of therapy maintained about the same relation, whether the X-ray showed complete clearing, an improvement or no change.

Fig. 10 is a striking comparison between the situation as stated on the questionnaire and the findings reported by X-ray. It will be noted that cases reported symptomatically cured were to a large extent found to be cured by X-ray. Those improved in the one respect were likewise improved in the other, and the bulk of the patients who were unimproved symptomatically were found to have a sinus which showed no improvement by

Fig. 9. X-RAY FINDINGS.
(CHECKUP.)

Treatment	Complete Clearing	Improvement	No Improvement
Medical (Chronic Cases)	61%	57%	61%
Surgical (Chronic Cases)	39%	43%	39%

Fig. 10. X-RAY FINDINGS.
(CHECKUP.)

	Cured (symptomatically)	Improved (symptomatically)	Unimproved (symptomatically)
Clear by X-ray	43%	40%	17%
Improved by X-ray	0%	62%	38%
No improvement by X-ray	21%	17%	62%

X-ray. One would, therefore, be justified in concluding that so long as there is X-ray evidence of pathology, the clinical symptoms of nasal congestion and discharge will similarly persist. Most of us have, I think, had the feeling that a sinus once subjected to chronic inflammation might, even in the absence of symptoms, fail to show a return to its original clarity by X-ray without indicating the need of any special treatment. While this is unquestionably true in many instances, it would appear from these figures that there is a tendency for the two factors to maintain a close correspondence with each other.

It will be noted on the questionnaire that information was requested as to the frequency of head colds after any form of

sinus infection. While a certain number of head colds are almost a routine situation with any child, it is generally considered that the existence of sinusitis predisposes the individual to a greater than ordinary number of such infections. Sixty-four per cent of the patients reported being, as they usually put it, "subject" to head colds, while 36 per cent said they were not. A preponderance of almost two to one in this respect would lend some justification to the conclusion that sinusitis certainly carries with it the probability of an increased susceptibility to nasal infections. Such data should, of course, be checked by a comparison with the number of colds occurring in a group of children who had presumably never had sinusitis.

A word as to tonsillectomy. In the entire group of cases there were 62 per cent who had had their tonsils and adenoids removed before the recognition of the sinusitis. The therapeutic effect of the operation after sinusitis had developed has already been referred to. Certainly the operation will not ward off the occurrence of sinus infections, though these may well be less violent and of shorter duration because of the previous removal of infected lymphoid tissue.

What, then, are we to conclude to be the prognostic significance of sinusitis in children? If the inflammation is pyogenic in origin, is treated promptly, either medically or by conservative surgical measures, the condition will in general subside without leaving after effects that will be detrimental to the general health beyond a greater tendency to recurrent nasal infections. If, however, the infection progresses untreated, to a chronic state, or if, particularly, the sinusitis is but a local manifestation of general systemic allergy or other dysfunction, then the sinus disease will persist and continue to occasion local symptoms until the underlying cause is discovered and eradicated.

SUMMARY.

1. Sinusitis in children has become during the past ten years a well recognized entity, underlying local nasal symptoms and contributing to systemic disturbances in a relationship formerly never dreamed of.

2. Certain types of sinusitis are amenable to local and, particularly in the acute cases, surgical treatment.

3. Many cases of chronic sinusitis will defy all local measures, whether surgical or medical, and can only be relieved by investigation of the underlying physiologic and biochemical dysfunctions which exist in the individual patient. Allergic disorders will be found to play an important rôle in this connection.

4. In general, the existence of nasal symptoms will be found to parallel the existence of a pathologic state in the sinus as evidenced by X-ray.

5. Only by study and investigation with every clinical and laboratory facility at hand, principally in a hospital, can adequate study of these conditions be satisfactorily carried out.

319 LONGWOOD AVE.

LXXXVI.

MANAGEMENT OF THE FRACTURED NOSE.*

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TORONTO.

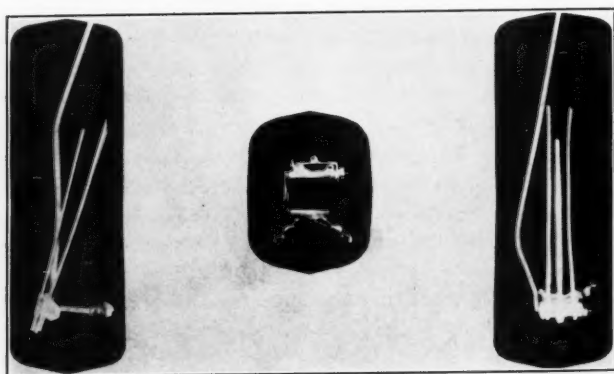
In considering this subject, we have divided it into recent fractures and old fractures with deformity. In the recent fracture the cause is usually sudden force, as in automobile or aeroplane accidents. The diagnosis, as a rule, is simple, due to the visible deformity, crepitation on digital examination, some nasal obstruction, and under most conditions certain X-ray evidence. We do not believe that X-ray is of very great value in the uncomplicated nasal fracture, as one usually arrives at a conclusion clinically, but the X-ray should always be taken from the medico-legal standpoint. The prognosis from the standpoint of deformity should always be guarded, but we believe if adequate splints are at hand very good results should be obtained.

The treatment is reduction of the fracture, or better, elevation of the fracture and immobilization of the parts. Of course, there are a number of these nasal fractures that do not require a definite form of immobilization but when they are comminuted and complicated, as one sees cases due to sudden violence, a splint is indicated. We have tried packing with gauze, and the use of porous internasal splints, which are merely left in the nose as packing, but we have been driven to the conclusion that the ideal splint must elevate the depressed and fractured nasal bones and spine, and at the same time mould the nose externally. We are now using a splint which we believe is most useful, in that it is fixed, the internal elevation necessary to obtain the correction is easily gained, and at the same time attached to this same splint is a bar which serves to maintain the nose externally in its proper relative position. It is generally necessary to maintain the splint in position for from five to eight days in the recent fracture, but

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when it is complicated by a fracture through the superior maxillary bones, then the splint maintaining the upper jaw in position should not be removed under five weeks. Further, where there has been laceration about the face, splints are still of considerable use, but, if it is possible, the lacerated area should be exposed, as we strongly believe that seldom is a dressing necessary on the face, and when sutures are exposed to sun and air they remain dry and cause the minimum of scarring. Most of the sutures introduced about the face should be removed before the fourth day. We strongly approve of horsehair for superficial sutures.

We will attempt to show by lantern slides the types of splints we favor, but will here attempt a brief detailed description of such. The first type we wish to describe is one used when the nose has been fractured, perhaps laterally, but where there is little or no impaction or depression. In these cases we use a case appliance made to fit the upper teeth with a bar running at an angle to the forehead, and this bar attached to the forehead with a flat piece of dental compound, which when chilled will be held by adhesive. That means that we have an upright bar close to the nose on either the right or left side, whichever is desired, and fixed in two positions, namely, to the teeth and to the forehead. A piece of thin lead is now moulded to fit over the reduced or remodeled nasal bones, and this is held in position by further dental compound, which projects far enough laterally to engage the wire which we mentioned, fixed to the teeth and forehead. When this compound has been chilled, the nose is firmly held in the center line. So much for the fracture, which is not depressed, but most of the nasal fractures we see today are depressed, owing to the comminution of the nasal bones and the nasal spine. There is a lack of support when the parts are elevated, and we have tried packing with gauze, but gauze is likely to slip to a lower position in the nose unless the packing is very firm, but for fear of meningeal irritation we do not favor nasal packing. We have attempted to construct a splint which we think is more ideal than the one previously described, because it allows for elevation and at the same time pressure can be made over the nasal spine and nasal bones externally and internally. In this way we not only obtain elevation, but mould the bones externally in the



upper nasal region. The appliance itself is similar to the one described, with the exception of a little attachment to the upright bar which permits a movable cylinder to lie at right angles to the nose, and this cylinder is held in position by a little lock or nut. To this movable cylinder is soldered three square tubes at right angles to the cylinder, and in these square tubes square wires are inserted, two of which wires are for extension into the nose and the third one, more centrally placed on the cylinder, for an external wire to allow for pressure on the nose. The two inner square wires are used to elevate and the outer square wire to control the elevation, as it may be attached by dental compound, as we described before, to a moulded lead plate, overlying the nasal bones. This cylinder may be rotated on the little bar attachment and in this way give further elevation and then held in position by a small nut. In other words, we have this upright attachment which is fixed to the teeth and the forehead, to which is soldered a bar at right angles to the fixed wire and covering the little attachment is the cylinder which may be turned and held in position where the elevation may be needed, by a little nut. These square wires we spoke of passing through the small square tubes on the top of the cylinder and well up inside the nose, permit of elevation on rotation of the cylinder. It is difficult to describe any apparatus, but we will show it perhaps in a clearer way by the lantern slides.

In the old fracture, where the parts have been allowed to heal in a malposition, we refracture and attempt to bring the parts to their original position. We have tried using chisels and saws for refracturing, but we have found that most of the cases could be well handled with a large flat duck-billed forcep, intranasally. All incisions are made intranasally, and when the nasal bones and nasal spine have been refractured, it is necessary, as a rule, to hold them in an elevated position. Here we find that the movable splint described above is quite satisfactory. In many of these cases we believe that a total submucous resection is necessary, but there are cases where a submucous is contra-indicated, especially where, perhaps owing to an accident, there is a loss of nasal bridge support. At any rate, most cases requiring this form of treatment will be helped by a submucous resection, which is done

at the same operation but previous to the refracturing. It has been our experience that a large percentage of the cases requiring refracturing of the nasal bones and the nasal spine will require a further operation two months later to supply the additional support in the form of cartilage. There is flatness about the old depressed nose which is not overcome by refracturing and elevation alone, but which requires a cartilage transplant to obtain a pleasing result. By that we mean a result may be obtained whereby a man may resume his employment without the stigma of syphilis. Many of these patients have been denied employment because of their deformity. We have used ivory and gutta percha in place of cartilage, to obtain this elevation, and in some cases the ivory seemed quite successful. We have one or two cases where the ivory has been in for five years, but a large percentage of them returned with the ivory projecting either through the mucous membrane of the nose or through the columellar incision, and it had to be removed. Consequently, we believe that cartilage is preferable to bone or any artificial substitute.

This paper is written pleading for more attention to be given to the fractured nose. We believe that these cases are neglected, not because the deformity is overlooked, but due to the difficulty in obtaining adequate splints to immobilize the fractured nose. We do not know of any universal splint on the market that is of value, and consequently we have attempted to describe what we are using, hoping that many suggestions will be made for the modification and improvement of the present methods of nasal splinting.

MEDICAL ARTS BLDG.

LXXXVII.

THE DIAGNOSIS AND CONSERVATIVE TREATMENT OF SPHENOID SUPPURATION.*

W. A. WAGNER, M. D.,

NEW ORLEANS.

Excellent but few contributions have been made to the literature on the subject of sphenoid suppuration, and comparatively little original work has been done during the past several years. The sphenoid sinus, as is well known, is obscurely located, and although it is only a small part of the respiratory mechanism it nevertheless merits special attention.¹ Suppuration may involve the sphenoid separately, but is usually associated with an ethmoid involvement. Infection involving this sinus, with or without posterior ethmoid involvement, is most difficult and one of the rarely diagnosed of sinus infections.² The reason for this is apparent when one considers the mild and oftentimes vague symptom complexes together with the almost inaccessible location of these cavities. No doubt some sphenoids with a low grade infection have escaped detection for years, having been considered merely a chronic catarrhal condition, until the sudden appearance of a severe ocular disturbance or another complication invited immediate attention.

Of all the sinus suppurations, the sphenoid is probably most dangerous, because of its being surrounded by the meninges, the cavernous sinus and its contents, the carotid artery, the hypophysis and the optic nerve and chiasm. Therefore, to avoid any serious complications from extension of infections and to expect rapid recovery, early diagnosis and proper treatment are imperative.

A. DIAGNOSIS.

It is only by intelligent interpretation of subjective symptoms and objective physical findings that diagnosis reaches a firm founda-

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dation, and especially is this exemplified in the diagnosis of sphenoiditis. Sphenoidal suppuration, with which this subject deals, is less difficult to diagnose than the hyperplastic type, although "there is one clue," as Skillern³ has said, and that is the "appearance of the middle turbinate." The body of this structure appears slightly hypertrophied and frequently has a mottled appearance. Today one has learned there is more to the diagnosis of sphenoid suppuration than the mere appearance of the middle turbinate. The diagnosis is dependent upon a scrupulously detailed history and a carefully scrutinized study of the objective physical findings, the radiographs and the cytologic washings.

I. HISTORY.

The various symptoms associated with sphenoid suppuration are numerous and vary from simple headaches to the peculiar symptom complexes, some of which are seemingly unattached to the sphenoid. No doubt the morphologic variations are a factor in the symptomatology of this disease.⁴ So evident is this that occasionally sphenoidal suppuration may simulate intracranial lesions, and because of the seriousness and magnitude of such an operation as an exploratory craniotomy, and the dangers of a sphenoidectomy, every procedure available should be used in the differential diagnosis.⁵ Sphenoidal infection may occur in children, as Myerson has reported a death in a child, five years old, from meningitis in which the sphenoid sinus showed pus.⁶ Shaeffer, Shea^{7,8} and others have called our attention to the development of the sphenoid in children as young as three years of age, consequently a sphenoidal suppuration at that age is not impossible, and therefore one should bear in mind the possibility of a sphenoid involvement in childhood. Three such cases have come under my observation recently, corroborated by radiographs and cytologic lavage. MacGibbon, in a paper on sphenoid-ethmoiditis, states that this condition is common in sections of Australia, stating that 50 per cent of the children of Christ Church have infection of the ethmoid and sphenoid sinuses.⁹ Although I do not doubt this statement, I do believe that we have less involvement of the sphenoid in this country. Children with impaired vision, as existed in my cases, in whom there

is no pathology within the eye to account for the diminished visual acuity, should require an investigation of the sinuses, especially the sphenoid. Often we are surprised at the size and degree of development of this sinus in children. Radiography in the Hirtz position and cadaveric study have demonstrated this repeatedly.

Sphenoid suppuration may be acute or chronic. Acute suppuration manifests itself clinically with symptoms suggestive of a cold, very closely resembling other acute sinus infections. It may be the initial involvement or it may be an exacerbation of a chronic one. The symptoms are very similar to those of the chronic except that the attack is sudden, the headache, neuralgic pains and tightness in the head are most intense and the vertigo may be pronounced. The optic neuritis may result in a transitory blindness and the field of vision and color acuity may be so affected as to produce a temporary color blindness and contracted visual fields.

The history is one of upper respiratory affection, with a tendency to recurrent head colds, headaches; throat, nasal and mental symptoms, ear and ocular manifestations, and many general symptoms apparently referable to the sphenoid.

Headaches are produced as a result of toxemia and pressure within the sinus, rarefaction from vacuum, or irritation of the Vidian nerve and the sphenopalatine ganglion resulting in the "front half" type of neuralgic headache in which the pains are typically sensory along the distribution of the fifth cranial nerve, and the "back half" type myalgic with myalgic nodes, vasomotor in origin, along the distribution of the occipital nerves, accounting for the Vidian syndrome and Sluder's "lower half headache."¹⁰ Pain originating in the eye may be found radiating to the temple, to the mastoid region and to the nape of the neck.¹¹ The mastoid pain may become such as to simulate the pain of mastoiditis. Firrot, in 1927, cited three cases of simulated mastoiditis in which the patients were relieved by sphenoid drainage.¹² Occipital pain, so frequently a manifestation of sphenoid infection, is the result of Vidian nerve irritation in which the reflex is carried through the great deep petrosal nerve to the carotid plexus, thence to the superior cervical sympathetic gan-

gion, to the cervical plexus, and finally through the three upper cervical spinal (occipital) nerves. Occipital pain localized over the mastoid is often associated with vertigo and tinnitus, and when occurring together is spoken of by Oaks and Merrill as "the sphenoidal sinus syndrome."¹³ Bertermes, in 1925, reported a case with occipital and mastoid pain in conjunction with wry-neck, in which rapid disappearance of the pain and torticollis occurred after sphenoid treatment.¹⁴ The sphenoid discomfort varies from a heavy, steady aching to lancinating, stabbing pain or a burning sensation; and the area described is often sensitive to superficial pressure.

Throat and nasal symptoms are: Coryza, as before mentioned, postnasal discharge occasionally with scab formation and constant hawking, often associated with hoarseness or aphonia; anosmia; subjective odor; parosmia; dry cough; clearing of throat and gagging.

Mental symptoms simulate those of neurasthenia and may be severe enough to produce delirium.¹⁵ They may be best expressed as Citelli's syndrome, which was again called to our attention by Caleciti in 1925, characterized by defective memory, somnolence, insomnia, intellectual deficiency and unwillingness to concentrate.¹⁶

Ear symptoms are: Diminished hearing, tinnitus, vertigo, fullness, otalgia and splashing in ears. Sluder,¹⁷ 1926, called our attention to diminished hearing with an associated fullness, and attributed it to eustachian salpingitis resulting in catarrhal deafness. During the same year the superior cervical sympathetic ganglion syndrome, described by Palmer,¹⁸ gave an explanation to account for the tinnitus and vertigo which so frequently accompanied sphenoid infection. Through irritation of the superior cervical sympathetic ganglion which supplies the nervi vasorum of the internal auricular branch of the occipital and the auditory arteries to the labyrinth, hyperemia of the organ is produced, which brings about the tinnitus and vertigo. Therefore, vertigo and tinnitus are not due entirely to toxemia. Vertigo may be expressed as "giddiness" or "light-headedness," or a "feeling of falling." It is usually experienced upon motion of the head or when walking, stooping or turning.

Ocular manifestations are: Redness of eyes, pain in and about the eyes, asthenopia, muscle imbalance, photophobia, impaired vision from optic neuritis or atrophy, and always suggestive are the refractive states that vary with repeated examinations and little improvement. Diminished visual and color acuity and concentric contraction of the color fields often associated with central scotoma (relative or absolute), enlargement of the blind spot and pallor of disc.^{19 20 21 22 23 24 25 26 27 28 29 30 31 32 33} One should be cautious in considering sphenoid infection as a cause of optic neuritis, as thirty-four other causes have been enumerated by Vail.³⁴

General symptoms are nausea, vomiting, gastric irritability, respiratory disturbances, arthritis, polyuria, polydipsia, afternoon fever and increased pulse rate.

II. OBJECTIVE PHYSICAL FINDINGS.

Because of the diversity and great variations of the subjective symptoms of suppuration of the sphenoid sinus, it must be remembered that a reliable diagnosis cannot be based upon symptoms alone, consequently objective physical findings play an important part in the diagnosis.

The rhinoscopic findings: There may be a septal deflection with secretions in the olfactory fissure noted after overcoming the turgescence. The pus appears either anteriorly between the middle turbinate and septum or posteriorly in the nasopharynx occasionally with crusting, and located toward the choana. Often the oropharynx shows a dry, glistening appearance, periodically streaked with pus, and while at times the secretion forms in crusts on the roof of the nasopharynx it appears as fluid pus in the nasal cavity. When the drainage of pus is scanty, nasal suction may facilitate its detection within the nose. In addition to the turgescence the inner side, and particularly the posterior tip of the middle turbinate, may show hypertrophy or hyperplasia, and if the case is of long standing the mucosa may assume a translucent appearance not unlike a beginning polyposis.

The presence of pus on the cotton of an applicator passed into the olfactory fissure or into the sphenoid sinus demands further investigation. Nasopharyngoscopy is of much assistance, al-

though it may not always bring the ostium of the sphenoid into view, it frequently gives a fair view of the pus streaked olfactory fissure and sphenoid recess. It demonstrates hypertrophied turbinates with their polypoid posterior tips, dilated blood vessel, granulations and edema about the sphenoid ostium.

The pharynx, in addition to the periodic dryness and its pus streaked wall shows the typical granular and follicular pharyngitis with its enlarged or suppurating posterior pharyngeal lymph nodes and scar tissue infiltration. The ears may reveal a catarrhal deafness, noted by the functional tests and findings in the middle ears.

III. RADIOGRAPHY.

The consensus of opinion is that radiographs of the sphenoid seldom show pathology. This opinion, no doubt, was brought about by the unsatisfactory radiography of the sphenoid sinus in the past, which led to erroneous conclusions. This was due not only to faulty technic and lack of standardization of positions but especially to the routine use of a single position. It is my practice to require two positions, the Granger,^{35 36} 107° angle (anteroposterior) and the Hirtz chin-vertex (vertical),³⁷ supplemented by the Rhese (oblique)³⁸ and Scheier (lateral).³⁹ Radiopaque substances, such as lipiodol, are used as an auxiliary agent. It is of value in diagnosis of obscure conditions of the sphenoid, as it serves a twofold purpose. It aids in determining the thickness of the lining membrane, and in the prognosis, as it is known that a long elimination time is indicative of a badly functioning membrane. Radiopaque substances may be instilled into the sphenoid or may be introduced by the Proetz⁴⁰ displacement method.

The Granger position is the most generally used. In sphenoidal suppuration the "G" line becomes blurred or disappears.

The Hirtz position I have used some time as the position of choice for delineation of the sphenoid, particularly when a contrast medium is used. This position is also of value, as it demonstrates extension of infection from the sphenoid to the base of the skull, as shown by Pfahler.⁴¹ With the head in the proper position the fluid level is clearly defined, and with the aid of contrast medium, by changing the position of the head, it is possible

virtually to reconstruct the cavity to be studied by means of exposures made in different planes. Because of the necessity of having a fluid level in making the Hirtz position it becomes necessary to have the patient in the sitting position with the head extended backward about 60° . In this position a fluid level will be seen in the sphenoid sinus, as well demonstrated by Baum.⁴² When suspicious of an optic nerve involvement and radiography of the optic foramen is necessary, the Rhese position is of value, as the foramen are clearly demonstrated within the orbits and their size and relation to the sphenoid are noted.

In the interpretation of radiographs the most essential point is the quality of the film. It is necessary that the film be of less density and less extreme contrast, so that it may show the minute bone changes, the presence of finer changes in the soft tissue and the presence of fluid within the sphenoid.

IV. EXPLORATION.

Exploration or irrigation of the sphenoid sinus as a diagnostic aid has no equal in certainty and rapidity for determining the presence or absence of pus within the sinus. Irrigation with cytologic study during a remission is of much diagnostic and prognostic value. During acute infections and exacerbations of chronic infections, microscopy is unnecessary, as the pus is demonstrated in the washings.

In many cases irrigation is done with little difficulty when the olfactory fissure is of sufficient width to permit the passage of the canula or trocar, but, on the other hand, greater diagnostic difficulties are encountered in cases in which the olfactory fissure is narrow and the anterior wall of the sphenoid and the ostium are not visible or a posterior ethmoidal cell overlaps the sphenoid.

Such a procedure is not free of danger, as penetration into the cranial cavity or hemorrhage may occur. Myles, in 1882, made the statement that the sphenoid sinus was beyond the reach of human attack. Zuckerkandl first offered the suggestion that the sphenoid sinus could be penetrated by means of a trocar, and since then Schaeffer, who first investigated the sphenoid, was soon followed by P. Watson-Williams, Sieur, Jacobs, Menzel, Hagman, Lobell, Spielberg, Ingals and many others.

Investigation of the sphenoid sinus should be confined to cases which present signs and symptoms which may be directly referable to the sphenoid. There are three groups of cases that require such investigation. Group 1 comprises such as manifest local and constitutional symptoms which could be traced to the sphenoid, such as occipital headache, tinnitus, vertigo (sphenoid syndrome); pain back of the eyes or over the mastoid, mental symptoms, nasal obstruction, postnasal discharge, etc. Group 2, those patients who develop a sudden loss of vision with optic neuritis in which no cause has been found. Group 3, patients suffering with intracranial complications, such as meningitis, brain abscess and general sepsis of undetermined origin.⁴³

The cases which comprise Group 1 require differential diagnosis, as they may easily be confused with posterior ethmoid disease.

The demonstration of suppuration in the olfactory fissure is a finding which indicates a disease of the sphenoid but is no absolute proof of its existence, as the objective symptoms are also somewhat characteristic of suppuration of the posterior ethmoidal labyrinth. Therefore, the two conditions should be considered together in the diagnosis until one has definite proof that the origin of the secretion is from the sphenoid sinus, and until then it is impossible to establish the diagnosis with certainty. This proof consists (1) in the direct observation of the purulent drainage from the ostium of the sphenoid sinus, and (2) in the demonstration of secretion from the sphenoid sinus by means of irrigation.

After a suppuration of the sphenoid exists the question arises, Is this the only source of suppuration, or is the sphenoid disease combined with an involvement of the posterior ethmoid labyrinth?⁴⁴ After irrigation of a sphenoid sinus containing pus, the reappearance of pus in the olfactory fissure proves its origin in the ethmoid labyrinth. And the observation of pus draining from the ostia of the ethmoid by means of the nasopharyngoscope also proves a combined ethmoid infection.

Groups 2 and 3 comprise cases in which the optic nerve is involved or orbital or intracranial complications are impending.

In such cases one must agree with Lynch, Beck, Hurd, Eagleton and others that conservative treatment gives nothing more than passing help.^{45 46}

B. CONSERVATIVE TREATMENT.

Conservatism, however, is an entirely relative term, and its implications vary at different times. In this discussion it implies any management of this disease save surgery upon the sphenoid or other sinuses. The conservative or nonsurgical treatment of sphenoid suppuration must be resorted to in properly selected cases for its successful application, and under no circumstances should anyone believe the nonsurgical methods a panacea, nor attempt to make them replace appropriate surgery in cases frankly surgical. Sphenoid surgery will ever play an important place in the practice of rhinology, but as the nonsurgical methods are better understood they will be given more and more consideration and possibly in the future supplant some of the surgery now in vogue.⁴⁷

Although conservative treatment comprises constitutional and local management, it would not be proper to discuss conservative treatment without at least mentioning prevention of the disease.

I. PROPHYLAXIS.

Today scientific medicine is more and more concerned with the consideration of the prevention of disease, consequently if the opportunity be given prevention of sphenoid infection should be practiced. The prophylaxis of sphenoid suppuration calls for (1) prophylaxis of acute upper respiratory infection; (2) general hygiene, with the prevention and correction of physical causes, as lack of exercise, improper clothing, chilling of body, loss of sleep, dieting, excessive perspiration with exposure, overheating, bathing, draughts, constipation, etc.; (3) nasal and oral hygiene; the proper education of children as to how to properly blow the nose and cleanse the postnasal space, to avoid nasal irrigations, to properly and regularly brush the teeth and cleanse the pharynx; (4) predisposing factors, such as allergy, mechanical nasal obstructions to ventilation and drainage, as septal deflections, neoplasms, hyperplastic turbinates and foreign bodies of the nose, should be properly handled; (5) diet should be regu-

lated, especially in regard to vitamins A and D; (6) the endocrines should be studied and any dyscrasia corrected; (7) all local infectious causes should be properly cared for, such as diseased tonsils, adenoids, teeth and gums; (8) plenty of sunlight should be recommended; (9) extrinsic and intrinsic factors which may cause or perpetuate a respiratory infection, such as exposure to heat, cold and excessive humidity in house or office, and gasses and vapors produced by poor ventilation should be avoided.

II. GENERAL TREATMENT.

Fortunately these cases usually respond readily to general and local management. When the condition occurs as a complication of some systemic disease (e. g., influenza, scarlet fever, etc.), the general treatment must obviously include the treatment of that disease. The marked tendency to recurrence, even after constructive surgery⁴⁸ (submucous resection, turbinectomy, infraction of turbinates, polypectomy, tonsillectomy, adenoidectomy and teeth extraction), seems to prove a constitutional basis in many cases. Internal or constitutional remedies should, therefore, play some part in their management. The treatment in acute cases should begin with rest in bed and a thorough cleansing of the alimentary tract. In the chronic cases presenting evidences of lowered vitality or resistance constructive tonics should be prescribed, and in the overfed, full-blooded or plethoric cases careful regulation of diet, restriction of alcoholic drinks and regulation of bowels should be advocated. In all cases, smoking should be discouraged. Suitable regular exercise should be recommended, diet should be regulated so that patient receives sufficient vitamins and plenty of fluids with alkalinization.^{49 50} Atropin in small doses frequently administered by mouth is an aid in acute cases in checking glandular activity. Iodids, urotropin, salicylates and colloids have been of questionable value. Occasionally when sphenoid suppuration is a part of a pansinusitis, the result of a metabolic upset incident to heart, kidney or gastrointestinal diseases, it becomes necessary to treat these conditions. When the background is specific, such as lues, tuberculosis, diabetes, etc., insist upon specific treatment in conjunction with the other methods of therapy. Proteid therapy (milk, omnadin, aosan, caseosan,

novoprotein, phylogetan, terpichin, caseal, lactosen, yatren, casein, atomasin, alfasol, tuberculin and typhoid bacillus), bacteriophage, vaccines and leucocytic extract (Hiss) have proven of little value, although Herelli⁵¹ has reported good results with bacteriophage in other infectious diseases, and it would be interesting to know its results in sphenoid disease.

III. SYMPTOMATIC TREATMENT.

Symptomatic treatment consists in the relief of pain and headaches by means of anodynes, narcotics, analgesics, physiotherapy and electrotherapy. Cocainization of the sphenopalatine nerve or injection of the nasal ganglion is recommended in those cases where neuralgia is an aggravating symptom not relieved by anodynes and in patients who resent surgical intervention. The restoration of nasal ventilation and the favoring of the discharge of secretions will be discussed under local treatment.

IV. LOCAL TREATMENT.

In regard to local treatment, the re-establishment of drainage and ventilation is the objective.

1. *Shrinking Solutions*.—Cocain, metaphedrin, ephedrin, adrenalin, adrephin, etc., have been used. The use of these drugs for shrinking the turbinates is so generally known that extensive discussion would not add to their recognized merits.⁵² They may be used in the anterior nares or when enlarged turbinates or deviated septums make it impossible for the solution to reach the diseased area, the oral or nasopharyngeal route suggested by Pressman⁵³ is preferable.

2. *Suction*.—It may be used in cleansing the meatuses of the nose in place of irrigation and for draining the sinus when the head is bent forward with the ostium dependent.

3. *Packs*.—The packing of the nose with various silver preparations (argyrol, silvol, collene, ichthyol and glycerin) and dyes, as recommended by Dowling and Skillern, has not given me the results that others have claimed for them.

4. *Lavage*.—Lavage or irrigation of the sphenoid, in addition to being of diagnostic importance, is of great therapeutic value. It is surprising how the removal of a small mass of pus by lavage

will give marked relief of symptoms. Lavage may be done as Lobell⁵⁷ has described, by means of the direct (through ostium), or indirect (by puncturing its anterior wall with a needle and forcing the return flow through the ostium) method. An indirect puncture of the anterior wall made after radiographing the patient with the needle in place facilitates the procedure and makes it an accurate and safe one. It is the method of choice in cases where the ostia are small and displaced or the pus very thick and inspissated. Lavage at times is impossible because of nasal obstruction. Many canulæ and needles have been used for this purpose.^{58 59}

5. *Displacement Irrigation*, as recommended by Proetz,⁶⁰ is of some value. Many drugs have been used, but normal saline has been my choice. The important factor in this type of therapy is the dilution of the pus, which facilitates removal, although at times it is difficult or impossible to have the fluid enter the sinus.

6. *Diathermy*.—Submucous electrocoagulation (Beck)⁶¹ of the turbinate overcomes the turgescence and shrinks the hypertrophied or hyperplastic turbinate.

7. *Radium* has been recommended as an adjunct in cases associated with ethmoid involvement where polyps may interfere with drainage and ventilation of the sphenoid.

8. *Ultra-violet irradiations* of the nasal ganglion have been advocated by Odeneal⁶² for the relief of pain.

9. *Steam inhalations* often aid in shrinking the nose and are cooling and refreshing to the nasal cavity and throat, and give relief from tracheal irritation in acute cases.

10. *Heat* applied to the side and back of the neck has been recommended for the relief of occipital and mastoid pain.

11. *Intubation* with silk retention catheter was discarded because of its irritation to nasal mucosa.

12. *Powder insufflation* of iodine, boric acid, etc., is found to be irritating.

13. *Instillation* of drugs, such as antiseptics and ferments, have been discouraging, and the use of oils, jellies and ointments in the sinus or nasal cavity are not theoretically correct from a pharmacodynamic viewpoint.⁶³

14. *Ionization* of the sphenoid was used in our clinic as early as 1925 and discarded; nevertheless, Campbell found it in some cases especially useful.^{64 65}

15. *Besredka antivirius*⁶⁶ has had very little trial, although in my limited experience it offers sufficient encouragement to warrant further investigation. Of eight cases of sphenoidal suppuration treated, six were treated by instillation and are free from pus and symptomatically well for a period of one to eleven months. The other two cases were treated by the Proetz displacement method, using the antivirius, and both are apparently well. None of the above eight cases required surgery.

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LXXXVIII.

MASTOIDITIS IN INFANTS: A REVIEW OF THE LITERATURE WITH SUMMARY OF CASES STUDIED.*

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SANTA BARBARA.

In a book written in 1620 by Sir Thomas Brown he quotes from *De Arte Med. Infant*, IV, 9, page 156, edition 1577: "Omniboness Ferrarius, in mortal dysenteries of children looks for the spot behind the ear." In 1921, Renaud of Paris, France, reported the finding of pus in the mastoid antrums of infants who had died of cholera infantum. In 1922, at the University of Iowa, Dean and Byfield reported the finding of pus in mastoid antrums, and also in the nasal sinuses of infants who had died of gastroenteritis. In 1923 and 1925, the staff of the St. Louis Children's Hospital reported their findings and results in 15 infants with gastrointestinal symptoms upon whom mastoid operations had been performed. Eight recovered, seven died. A later report, in 1926 and 1927, gave the results in 30 cases of gastroenteritis associated with mastoid disease. In the latter series there were twenty-two recoveries and eight deaths. Ludwig F. Meyer,¹ in discussing this subject, takes a conservative attitude toward surgical treatment of mastoiditis in infancy. He questions the existence of the so-called masked mastoiditis but feels that an open-minded attitude should be taken.

These reports have resulted in much investigation and discussion regarding the existence of mastoid disease associated with gastrointestinal symptoms in infants. Some observers believe that it is only a coincidence, and that the mastoid disease is not an etiologic factor in the gastrointestinal disturbance. Marriott^{1,2} says that in his experience more than 85 per cent of all gastrointestinal disease is due to infections in the ear, nose and throat. The criticism has been made that many of these infants had

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mastoid operations without sufficient objective findings. In the series of cases considered here no infant was operated upon unless the indications were definite and the pediatricians in some cases delayed permission until they were observed for a few days. I do not believe that mastoids are operated upon now by any otologist unless the indications are definite. Some years ago an otologist made the statement that the pediatricist had repeatedly asked him to open mastoids where he did not see the indications for it. If mastoids have been operated upon needlessly, I think the pediatrician has been as much at fault as the otologist.

What are the findings that would warrant a mastoid operation in an infant with gastroenteritis? There are a great many opinions to be found in the literature. Whiting,² in 1910, stated that in infants the bony structures are soft and unresisting, and pus in the mastoid is apt to show itself promptly in subperiosteal accumulations of pus, with redness, swelling and edema. In infants, as well as in older children, he believes that it is safe to wait until there are signs at the fundus of the ear—i. e., swelling and bulging of the drum with sagging of the membranous portion of the meatus and signs of tenderness over the mastoid, before proceeding to the mastoid operation. He is of the opinion that unexplained variations of temperature, even in cases with signs of middle ear infection, are not sufficient indication for the mastoid operation. In very few of the cases considered here were the postauricular signs observed. Dench³ reported that he had operated on a number of infants for recurrent or chronic mastoiditis. In some cases this was the only indication for operation, while in others the operation was done not primarily to relieve the mastoid infection but because the infant was marasmic and no other cause for the marasmus was found.

Steinsleger⁴ reports nine cases in which he operated for mastoiditis in infants. There was no otorrhea present in seven of these, but caries of the mastoid areas was found as a rule. He warns that operation should not be delayed and that otitis is more common in young infants than has been supposed. Laponge⁵ reported three cases of mastoiditis in infants, eight to eleven months of age, in which the chief symptoms were fever and prostration. There were no gastrointestinal symptoms. One had had

a discharge from the left ear. In the other two, there was no spontaneous aural discharge, but paracentesis resulted in release of pus from the ears and temporary improvement. Operation was later performed, because of the persistent fever and prostration in spite of free drainage from the ears. In each of the above cases the mastoid was found to be infected and improvement after operation was rapid.

I believe that it is generally conceded by otologists that the cases in which a retro-auricular abscess is present usually recover rapidly. Morean⁶ reports five cases of mastoiditis in infants from four months to two years. Four had retro-auricular abscess and one had otorrhea alone. In each case there was a postoperative rise in temperature, dyspnea and death. No explanation could be given for the fatal outcome, but similar cases have been reported by others. Canuyt⁷ reported a case of mastoid infection with postauricular abscess in an eight-months-old infant. The antrum was opened and curetted and in less than twenty hours the infant developed high temperature, rapid pulse and respiration without evident cause and died within a few hours. Schwartz⁸ expressed the opinion that in infants up to the age of two years mastoidectomy is practically never indicated. While this observation was made in 1927, it seems quite evident that the author did not have in mind the so-called gastrointestinal class of mastoiditis.

Complications may develop very rapidly and early in mastoiditis in infants, and this fact is brought out in a case reported by H. B. Silver.⁹ A ten-weeks-old infant was admitted to the hospital with a history of upper respiration, infection of a few days' standing from which it had apparently recovered. On admission the temperature was high and there were convulsive twitchings. It became suddenly cyanotic and died four hours after admission. Autopsy revealed a left mastoid filled with thick green pus. In this case there were no physical findings to suggest the mastoid infection. In other instances, the progress seems to be very slow, and this point was brought out in a case observed in the St. Louis City Hospital. A ten-weeks-old infant had been in the hospital for six weeks. There was loss of weight, vomiting, diarrhea. Examination of ears revealed dull, bulging drums and sagging of the

superior and posterior canal walls. Incision of drums released pus from the middle ears. Paracentesis was repeated several times but no mastoid operation was performed. The infant died at the end of about nine weeks, and autopsy revealed pus in both mastoids and bilateral sigmoid sinus thrombosis.

At the St. Louis Children's Hospital a six weeks infant was admitted with bilateral otitis and vomiting but no diarrhea. There was no gain in weight and the temperature was above normal. This infant had a pyloric stenosis which was operated upon. The vomiting ceased but there was no gain in weight and the temperature did not return to normal. After a bilateral mastoidectomy there was rapid improvement in the general condition, the weight increased and the temperature returned to normal. Silver¹⁰ reports a case which is identical with the above, except that the mastoid operation was performed before the one for pyloric stenosis. He stated that the anatomic possibilities of a mastoiditis in the infant are not generally conceded, and although the antrum is small it is sufficiently differentiated to give rise to the classic picture. In observing the anatomy of the infant mastoid the deductions made are that the infant antrum is relatively larger than in the adult. These deductions have been made after examining many term infant mastoids and in some cases filling the middle ear and antrum with lipiodol or bismuth paste through the eustachian tube, then making X-ray plates. One of these is illustrated which shows in detail the semicircular canals. (Fig. 1.)

Retrouvey¹¹ reported thirty cases of mastoiditis in infants operated upon at the Bordeaux Hospital. In six of these there was no discharge, but the tympanum showed evidence of middle ear infection. All but three of the series showed postauricular subcutaneous abscess. In one of the three, with intact antrum cortex, death occurred from meningitis. There were five deaths in the series.

Jones¹² reports sixty-eight mastoid operations on infants under two years. His diagnosis depended, not on the typical local signs of mastoiditis, but evidence of middle ear infection and changes in the ear drum. This, combined with general symptoms of fever, restlessness and sometimes gastrointestinal symptoms. Segar¹³

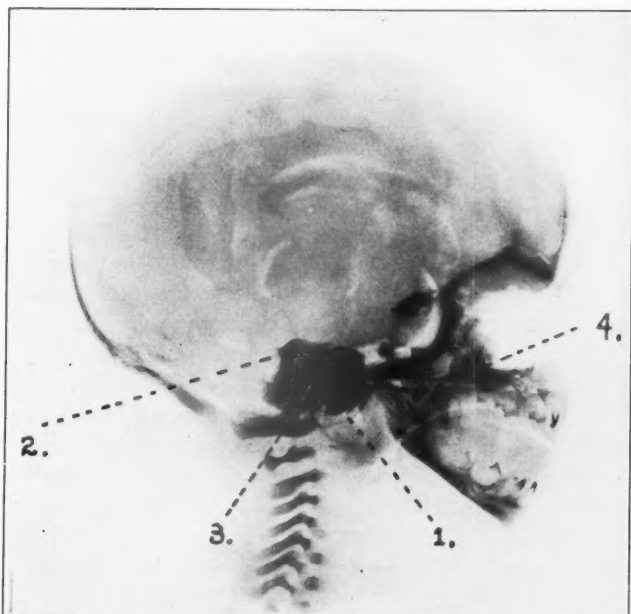


Fig. 1. Roentgenogram of a vertically sectioned infant head. 1. The annulus can be seen in its oblique position. 2. Two of the semicircular canals are plainly shown. 3. Lipiodol fills the middle ear and mastoid antrum, the latter appears to be almost directly above the former. 4. Lipiodol has been injected into the middle ear and mastoid through the eustachian tube.

and Stoeffler report a case of an eight weeks infant, in which the chief symptoms were fever and restlessness. *Staphylococcus* was cultured from a turbid spinal fluid, and the child died in ten days without being operated upon. Autopsy revealed creamy pus in the right mastoid and a right lateral sinus thrombosis. Cultures from the mastoid, sinus and brain showed the same organism found in the spinal fluid. No abnormality had been noted in the drum membranes in this case.

In cases of this kind, I think we would be justified in making an exploratory incision in the drum membrane in order to elimi-

nate the possibility of a mastoid infection. The aditus may be partly blocked by thick pus and give very slight evidence of trouble in the tympanic membrane. On several occasions I have incised the drum in this type of case and apparently there was nothing in the middle ear. Continued examination while the child was crying would reveal a gray bead of thick mucopus coming from the region of the aditus, and when crying ceased this bead of pus would disappear. I believe that mastoidectomy is indicated in this type of case because adequate drainage is not possible through the drum membrane. This may be due to the character of the pus or to anatomic conditions, such as pockets formed by reflections of membranes about the ligaments of the ossicles.

Renaud,¹⁴ in 1921, reported the finding of extensive suppurative processes in middle ear and mastoid at autopsy in seventy infants. In most cases the cause of death was given as infantile diarrhea, but yet the gastrointestinal tract showed no lesions. In thirty of this series the infants had been treated for otitis media during life. Renaud later observed that even though the drum membrane appeared normal, pus could be drawn from the middle ear by a syringe after the drum had been punctured. He felt that the drainage established by paracentesis was sufficient to relieve the symptoms in many cases, but in others the opening of the antrum is indicated.

Marriott,¹⁵ in 1925, states that in a number of fatal cases of severe nutritional disturbance in infants with watery diarrhea, prostration, rapid loss of weight, failure to retain fluid, a gray color of the skin, autopsies showed streptococcus infection in the mastoid antrum. The antrums were opened under local anesthesia in twenty such cases with the above symptoms. In all cases pus was obtained and streptococcus cultured. In a large proportion of cases the improvement was rapid following the operation. In this series there was sagging of the canal wall and changes in the membrane, but the usual signs of mastoiditis, swelling, redness and tenderness were absent.

Floyd¹⁶ reported twenty-six cases of mastoiditis in infants, observed at the College of Medicine, University of Iowa. The symptoms were similar to those observed by Marriott and the otologic findings were slight. In the early cases the diagnosis was made at

autopsy and the only pathology found was the thick pus "tucked away" in the mastoid antrum. In the later cases a mastoid operation was performed and in cases not too far advanced recovery was remarkably rapid. Jeans and Floyd¹⁷, at the same institution, in 1926 reported further observations in infants showing the symptoms of "cholera infantum." They found either paranasal sinus or middle ear and mastoid infection as the underlying cause. The ages of their patients ranged from four weeks to a year and a half. There was no evidence of mastoid involvement, and there was slight bulging of M. T., but seldom did free drainage follow myringotomy. The sign of greatest value and most constantly present was a sagging of the posterior superior canal wall. In only one instance did myringotomy establish drainage sufficient to bring about a recovery. Even though the infants appeared to be poor surgical risks, Jeans and Floyd found that the establishment of drainage was the only hope of bringing about recovery.

Alden and Lyman,¹⁸ at Children's Hospital, St. Louis, in 1925, reported fifteen cases of infants with athrepsia in which mastoid operation was done. Lyman,¹⁹ in 1927, reported forty-three infants operated upon. In the first report there were seven deaths in fifteen operations. Thirty of the forty-three reported by Lyman presented marked gastrointestinal symptoms, and in this group there were eight deaths. Thirteen did not present any gastrointestinal symptoms and in this group only one death occurred. These figures would indicate that mastoid infections with gastrointestinal symptoms in infants are much more serious than those without such symptoms. The cases with gastrointestinal symptoms that were operated upon were those in which all other possible sources of infection were excluded. They had failed to improve under proper dietary treatment, transfusion, intravenous and intraperitoneal administration of fluids combined with incision of the drum membrane. Examination of the ears in this series revealed red and bulging drums, most of the bulging being in the posterior superior quadrant and simulating a sag of the canal wall. In some cases the drum appeared a dull gray. Incision of drums usually showed pus. The predominating organism found on culture was streptococcus hemolyticus.

McMahon²⁰ studied the material obtained from the mastoids of thirty-nine infants included in Lyman's report, a total of seventy-one mastoids. True necrosis of bone was infrequent but some specimens showed marginal fragmentation and disintegration of bone. Two types of pathology was found, first a microscopic edema of mucosa and cells—second, a fibrosis. It was found that more deaths occurred in the edema type if the "vomiting diarrhea complex" was present. If this symptom complex was not present the prognosis was equally good with either type of lesion.

Rogers²¹ has found that in infants with middle ear and mastoid infection, the gastrointestinal and general symptoms are quite characteristic. There is diarrhea, increase in temperature and as the disease progresses there is pronounced dehydration. On otoscopic examination he finds peripheral reddening of the drum at first, and later it is a dull white and apparently thickened. He advocates mastoidectomy if the symptoms do not clear up after myringotomy. Rarely does he find postauricular signs of mastoiditis. Roentgen ray has been of value to him in diagnosing mastoid involvement in young infants.

Coates²² reviews the subject of masked mastoiditis in infants (reporting no cases of his own). In cases with continued fever, loss of weight, dehydration, diarrhea, vomiting with no obvious cause and failure to improve under general treatment, a careful examination of the ears should be made by a trained otologist. If the ear infection is sufficient to cause the syndrome, there will be some evidence of it found. A change in the drum to a grayish color with a loss of luster, slight fullness or redness, particularly of Shrapnel's membrane, slight posterosuperior canal wall sagging—"these are all that may be found." If myringotomy with free drainage fails to relieve the symptoms, postauricular drainage is indicated, "for copious, prolonged, increasing or at least nondiminishing aural discharge is in itself indicative of mastoid involvement." In cases with severe symptoms operation adds little to the hazards and may give good results. In a report of forty cases of mastoiditis in infants, Sidbury²³ feels that a bulging of the posterosuperior canal wall is pathognomonic of mastoid infection. Nine deaths occurred in his forty cases operated upon. Clausen²⁴ reports his observations in twenty-five cases of the

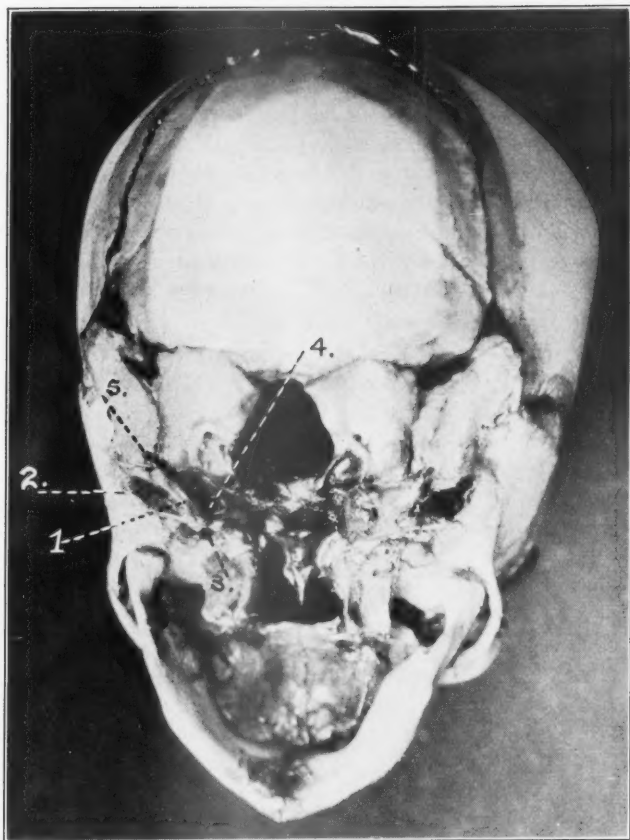


Fig. 2. Photograph of base of infant skull. 1, annulus; 2, tympanic membrane; 3, opening of carotid canal; 4, jugular foramen; 5, exit of facial nerve.

cholera infantum type. He, too, names as the most important local sign the sagging of the posterosuperior canal wall near the drum. Of thirteen cases with cholera infantum two were not operated upon and both died. Autopsy showed a bilateral suppurative mastoiditis. Of the eleven cases operated upon seven died.

There is a marked difference in the results reported by various observers. This may be due to the time the surgical treatment was instituted. In many cases operation is refused until it seems the only avenue left, and then I believe it may only hasten a fatal outcome.

Dr. L. W. Dean⁴⁰ cites the contributions to the literature of twenty-eight observers on acute otitis with marked systemic disturbance in infants, and describes twelve case histories of infants so afflicted. A personal study of the various conditions, as brought out in these observations, has been made by Dean. He feels that his conclusions may contribute a little to the management of a most difficult condition.

In Dean's opinion, the conception, up to 1910, of otitis in early childhood might be summed up in the following five observations made by G. Heermann:⁴¹

1. "Inflammation of the middle ear develops in young children in connection with severe exhausting disease states as an 'otitis concomitans.'

2. "This otitis forms a complication of the initial disease, but it produces none of the disease symptoms, and so far as has yet been shown, it exerts no influence on the course of the disease processes.

3. "The causative bacteria are found in the normal canal and external meatus. The patient's weakened organism furnishes the condition which permits the bacteria to be active.

4. "In certain cases this 'otitis concomitans' may develop into a severe complication, and it may then be difficult or impossible to distinguish it etiologically from a genuine otitis media.

5. "An otitis concomitans, as such, calls for no therapeutic measures. Should its symptoms become acute, it is sufficient to treat it as a genuine otitis media."

In the treatment of this disease many problems are encountered, and the author observes that best results can be obtained only by the complete co-operation between the otolaryngologist and the pediatricist. Their combined knowledge and skill cannot be overestimated.

The author's conclusions follow. The symptoms which lead to the discovery of otitis in infants are much more frequently

pediatric than otologic, as are also the conditions which decide the choice of treatment. Systemic disturbance, marked by food refusal, dehydration, diarrhea and loss of weight, etc., may be the factors which will indicate the need for myringotomy or for mastoidectomy. The pediatricist should not confine his work to general treatment, but should take into consideration the need of myringotomy or mastoidectomy. A positive diagnosis of otitis should never be made unless the objective sign of the otitis exists. In the author's opinion, otitis can always be diagnosed if it is present.

It is possible that paranasal sinus disease may cause all the symptoms of acute otitis except perhaps syncopal death. As this disease usually co-exists with acute otitis, it is generally advisable to treat both, although the decision as to which is the most influential in causing the systemic disturbance is frequently difficult to make.

Wallace Smith,⁴² in a discussion on this subject, gives the following as his conclusions: The most important changes are in the mucous membrane; osteomyelitis occurs rarely. Mastoiditis in infants occurs sporadically, and is not an etiologic factor in severe epidemic gastrointestinal intoxications. Cases of severe gastrointestinal intoxication, due to mastoid infection, have almost 100 per cent mortality if unoperated upon. Postauricular drainage is the rational treatment, is relatively harmless and is always done on both sides. Operation should be performed early and not as a last resort on a moribund patient. Pre-operative and postoperative supportive measures are obvious.

McCready,²⁵ in a discussion of mastoiditis in infants, names three types of abnormalities that he found on careful examination of the ear drums.

1. A thick, dense, white or gray drum with no bulging and slight or no light reflex.
2. A thin, "crinkly," lusterless drum with no bulging and absence of light reflex.
3. A normal looking drum with light reflex, but with bulging in the extreme posterosuperior part. This latter was the most common type in his cases.

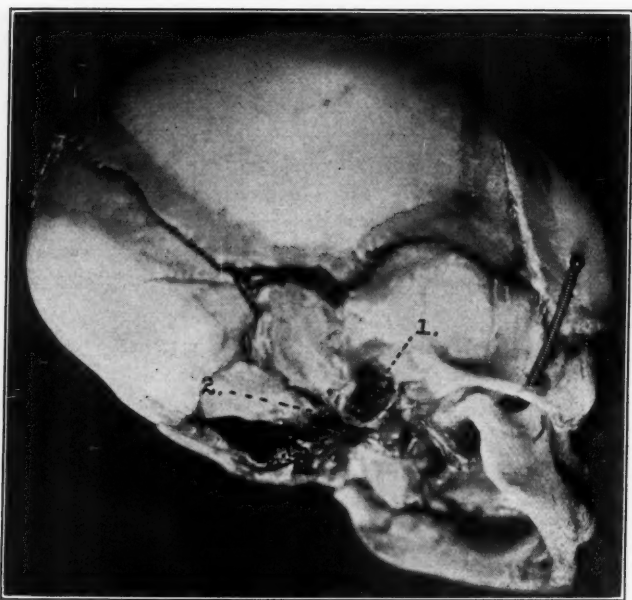


Fig. 3. Lateral view of mastoid region of infant skull. 1, tympanic membrane; 2, annulus.

Myringotomy is indicated in all three types, and if symptoms do not clear up mastoidectomy is indicated. Macneil²⁶ reports forty-five cases in which mastoidectomy was done at the Children's Hospital in Winnipeg. In 95 per cent the predominant symptoms were gastrointestinal. Some local ear signs were found in every case, usually a dull gray or yellow drum with posterior segment bulging. The leucocyte count was usually high. There were only two deaths in this series.

Costen,²⁷ in 1929, reported two cases of diarrhea, vomiting, fever and dehydration in which there was evidence of ear infection. The local findings were much the same as reported by previous observers. Both cases were operated upon and complete recovery resulted. From the Children's Hospital in Boston comes the report of Richards,²⁸—100 cases of acute nutritional disturb-

ances in infants of an average age of six and one-half months. The characteristic symptoms were fever, diarrhea, vomiting, dehydration, loss of weight and marked prostration. In the thirty-one recoveries there were fourteen with normal drums, fifteen showed redness or congestion, two with redness or bulging. In the fatal cases, twenty had evidence of congestion, seven redness and bulging, eight with discharge and perforation. In every case in which the drum membrane showed redness and bulging it was incised and, although the drainage of a purulent exudate was established, it had little effect on the symptoms. Of the patients with normal or congested drum membranes, half had one or both drums incised, either soon after admission or later. This procedure had no effect in reducing mortality. Antrum drainage was performed in twelve instances with nine deaths and three recoveries. The slight amount of pathology found in the cases that recovered indicated that recovery would probably have taken place with simple incision of the drum. In nine fatal cases the pathologic changes found varied from pale thickened mucous membrane to frank pus. Operative shock did not appear to influence the result unfavorably. The impression gained in these cases was that the infants were too ill to be benefited by having a subsidiary condition remedied. A study of middle ear and mastoids in 120 autopsies on infants at the Boston Children's Hospital revealed the following conditions:

In sixty cases in which death was due to acute nutritional disturbance, thirty-nine showed pus in one or both middle ears, with or without extension to the mastoid. In sixty cases in which death was due to other causes, thirty-four showed similar conditions in the middle ear and mastoid, a difference of only 9 per cent. Richards concludes that infection of the middle ear, with or without mastoiditis, is a prevalent complication of many diseases in infants, and that the findings in this series show no evidence that it is an important etiologic factor in nutritional disturbances in infants. He advises early incision of the drum in otitis media and feels that if there is not too great prostration this may turn the tide in the patient's favor, but that "operations on the mastoid will avail but little if adequate incision of the drum has proved futile."

Spahr,²⁹ in reporting a series of sixty-one mastoidectomies in children at the St. Louis Children's Hospital, in 1929, found that in every case where diarrhea was a symptom bacillus coli was cultured from the mastoid. Where local symptoms were present in the mastoid hemolytic streptococci was the most frequently found.

Babcock and Jones³⁰ advise mastoidectomy if the general symptoms do not improve after repeated myringotomies.

Carmack³¹ reports twenty-eight cases of mastoiditis in infants under two years, studied at Indiana University School of Medicine. In every case gastrointestinal disturbances were present. All were operated upon; twenty recovered, eight died. In nineteen the mucosa was swollen, and in nine the changes were of the sclerotic type. He describes the gray, lusterless drum, but found no objective signs over the mastoid.

Carmack summarizes his report, stating that his most unsatisfactory results were obtained when the mastoid operation was performed during the height of the acute bowel inflammation. He believes that operation should be delayed "until the storm subsides," and that there should be careful pre-operative treatment with fluids and blood transfusion in case of anemia.

Holsclaw³² reports that a study of diarrhea in infants at the Children's Hospital in San Francisco showed evidence of middle ear infection in many of them. In this series twenty-four cases were observed. Examination revealed grayish looking tympanic membrane, absent light reflex, a red drum, with or without light reflex, or redness with sagging of the posterosuperior canal wall. This latter was the most frequent finding. Eight died without operation, sixteen were operated upon with eight recoveries. From this study it is concluded that many diarrheas in infancy are toxic and originate from infection in the upper respiratory tract, particularly in the middle ear and mastoid.

Reporting the study of fifty-seven infants, Helwig and Dixon³³ found little evidence of bone necrosis in middle ear or mastoid. There was edema and swelling of the epithelium and the mucus contained pus and organisms. In the diarrhea cases operated upon the mortality rate was 41 per cent. They conclude that surgical

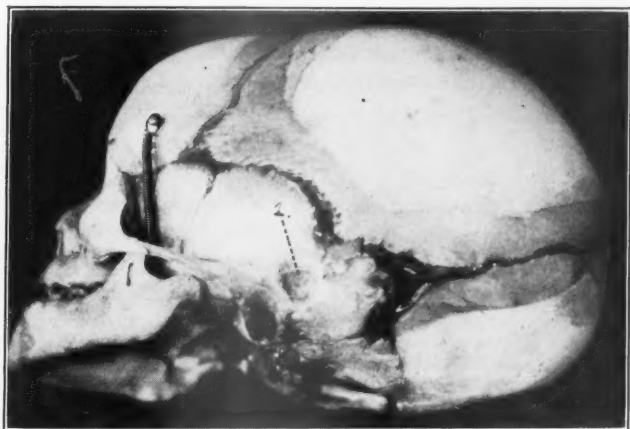


Fig. 4. Photograph of infant skull upon which the mastoid operation has been performed. This shows the average extent of the cellular structure found in infants under one year of age.

mastoiditis does occur in infants but its importance has been much overrated.

From the Hospital for Sick Children in Toronto comes the report of a five years' study of cholera infantum by Wishart.³⁴ In 324 autopsies, 49 showed fluid in one mastoid, 75 showed material in both mastoids; in 199, the mastoids were healthy. A series of 41 cases was studied in 1928, and 127 in 1929. They state that the incidence of ear infection was no greater in acute intestinal intoxication than in other conditions. Only two of 168 of the infants with cholera infantum developed clinical mastoiditis. They attribute the often mentioned gray drum to the general anhydremic picture. The author concludes that infection of the mastoid antrum is not the cause of acute intestinal infection in infants, and that operation on the mastoid should not be done on these cases unless there are symptoms of true clinical mastoiditis.

If we follow this advice, I am sure that a very small percentage of these infants will ever be operated upon; death will relieve us of this task. One case mentioned earlier in this paper illustrates the point: the ten weeks old infant with no clinical signs of mas-

toiditis died and autopsy revealed bilateral mastoid abscess and bilateral sigmoid sinus thrombosis. Another case, observed in 1927, had the typical gastrointestinal middle ear syndrome but no clinical signs of mastoiditis; operation revealed bilateral mastoid abscess and recovery was rapid and complete.

DIAGNOSIS.

The examination of infants' ears is a most important consideration, because from our findings we must determine what line of treatment is indicated.

A good light and head mirror is the most satisfactory method of examining the ear drum, but the electric otoscope is preferred by many. The objection to the latter is that we may be misled by the magnification. A red ear drum is not sufficient indication to warrant a paracentesis. It requires only a few seconds of manipulating a speculum in a canal to give a red ear drum, and I have been repeatedly asked to incise these. If we will carefully repeat our examination in a few hours a normal drum may be found. The most frequent change noted in the tympanic membrane has been a change in color to a drab or gray, an alteration in the landmarks, a fullness of Shrapnel's membrane or a bulging of the entire posterior half. A true sagging of the posterior superior canal wall is frequently observed. There is no objection to an exploratory paracentesis, either with a needle and aspirating syringe or a paracentesis knife. On account of the oblique position of the ear drum a sagging of the canal wall may be difficult to differentiate from a bulging of Shrapnel's membrane.

In the majority of cases examined there were no changes noted on the mastoid process. There was occasionally a slight thickening of the periosteum. In the typical uncomplicated case post-audicular changes are most common.

Examination of the eye grounds should be made in every case. An unsuspected lateral sinus thrombosis might be recognized from the findings.

A most careful general examination, including laboratory work, is most essential. A central pneumonia and pyelitis are often overlooked. Infections in the throat and paranasal sinuses are usually found complicating the middle ear and mastoid disease.

Repeated examinations should be made on these infants, as it has been noted that definite changes in the tympanic membrane may develop in a short time.

Carmack³¹ finds X-ray of considerable value in the diagnosis of mastoiditis in infants, although the plates are often difficult to interpret. The X-ray shows two types of pathologic changes. In the early or more active type there is a generalized increased density as compared with the normal. In the cases of longer standing the mastoid cavity may be transparent, but shows a band-like area of increased density around it.

Holsclaw³² made roentgenograms of the mastoids of infants, but none showed evidence of pathologic process.

Evans³⁶ found by X-ray examination that there was quite often considerable pneumatic structure present before the end of the first year. This fact makes the X-ray of value in telling just how extensive the operation must be, thereby saving some time.

Martin³⁷ finds that the mastoid cavity is not clearly demonstrated by the X-ray in infants under six months of age. Bilateral involvement makes the interpretation of plates more difficult. He cites four illustrative cases in which the X-ray findings were confirmed at operation.

Granger³⁸ made a study of roentgen ray plates of the mastoid region in infants up to two years of age. From three months to one year only the mastoid antrum is shown, and from one to two years the clear osseous substance of the mastoid is seen. He describes three types of pathology: (1) Infection with occlusion, cells opaque but osseous structure and cell walls visible; (2) infection with occlusion and softening, osseous structure and cell walls no longer clearly visible; (3) extensive destruction, lateral sinus wall visible, though it is not normally so in infants under two years.

Friesner and Rosen³⁵ describe a method of puncture of the mastoid which, after experiment on the cadaver, they have used on thirty infants without ill effect. Puncture is made on or just below a line drawn back from the upper portion of the condyloid process of the mandible. The puncture is made almost at right angles to the mastoid bone with a slight downward inclination

at a point three or four mm. behind the posterior canal wall. An aspirating syringe and a 19 gauge needle is used. The contents may be withdrawn for study or the antrum can be washed out.

If a diagnostic measure of this kind is indicated, why not quickly remove the outer wall of the antrum and open the few cells present? It would seem to me the safest procedure.

Repeated X-ray examinations are of value in telling us the actual change occurring in the mastoid from day to day. I believe that my greatest help from this has been the knowledge of the size and location of the antrum. The anatomy of this part is as variable as any other in the body. In the dissection of infant ears the variation in sizes and location of the antrum has been striking, as has also been the variation on the two sides. In some cases it was noted that the antrum position approached the adult condition while in others it was located well above the annulus. Several infant heads were studied by sectioning in the midline, and after making a small opening in the outer wall of the antrum lipiodol was injected into the middle ear and antrum through the eustachian tube. An X-ray plate of one of these half heads is here reproduced.

SURGICAL TREATMENT.

In some cases a free incision of the drum membrane is all that is required. It may be necessary to repeat this operation, but I believe that the indication for repeated incisions is also an indication for opening the mastoid.

Canuyt⁷ advocates the simple incision of a subperiosteal postauricular abscess without opening the mastoid cavity. In twenty-three cases operated upon in this manner he had no deaths.

Schwartz⁸ expressed the opinion that in infants up to the age of two years mastoidectomy is practically never indicated. He also advises simple incision of postauricular abscess. In his experience early incision of the drum, with adequate drainage, aided by suction if necessary, is usually sufficient to relieve the mastoid infection in infants.

I do not believe that the treatment suggested for this type of cases would be applicable to the ones with the gastrointestinal-mastoid syndrome.

Lyman¹⁹ makes an incision close to the auricle, extending upward from a point opposite the middle of the external auditory meatus. The area over the mastoid antrum is exposed and the bony cortex removed with a sharp gouge. The antrum is cleaned out and cultures are taken. Overhanging bone is removed with a small curette. A rubber or gauze drain is inserted and dressings changed daily after operation. The antrum is kept open until discharge from the canal ceases.

McCready²⁵ is of the opinion that the opening of the antrum and curetting away of the pus and granulations from the antral mastoid cell is not sufficient in infants. He finds that in almost all cases small adjacent cells filled with pus have been found, located in front toward the zygoma and posterior along the tegmen. He notes that the mastoid operation is not considered complete in older children and adults unless these cells are removed.

Macneil²⁶ uses a technic which differs but little from that in adults.

Carmack³¹ advocates the removal of all necrotic tissue and provides free drainage. The wound is kept open until the mastoid cavity heals by granulation.

Holsclaw,³² in fatal cases in which no involvement was found at operation, at autopsy showed that the mastoid cells had either been aberrant and had not been entered or had been only partly removed. The mastoid cells that remained contained pus and granulation tissue.

OPERATIVE TECHNIC.

The operative field is prepared in the usual manner and 2 cc. of 1 per cent novocain with 1 m. 1/1000 adrenalin chloride solution added to each 4 cc. is injected for each side. Everything should be in readiness so that there will be no waiting for syringes to be filled, dressings procured and obviate all lost motions. The greatest speed possible, consistent with accuracy, is most essential.

The incision is made as close to the auricle as possible, from a point opposite the middle of the external meatus and extending up about one inch. The periosteum is incised and elevated forward so that the posterosuperior portion of the annulus can be seen. The periosteum is not elevated posteriorly.

The point where the antrum is to be opened is now exposed by placing in position the self-retaining infant mastoid speculum devised by Lyman. A small mastoid curette is used to remove the cortex and to uncap all the cells present. These are located quite superficially and little time is required in carrying out the technic. These cells may extend back a considerable distance in the angle above the sinus knee. All overhang is removed, but the antrum is not curetted. A small explorer is passed carefully into the antrum and aditus. A small wick of gauze is placed in the antrum and a drain is also placed in the canal. No sutures are used and the dressings are not disturbed for three or four days.

The time required for operating upon one mastoid is from four to eight minutes, and the postoperative shock is very slight. The infants are fed soon after returning to their bed, and all recognized general treatment is continued as before operation. Various antiseptics have been tried in carrying out the postoperative treatment but little difference could be seen in the results. The drainage of pus from the mastoid cavity seemed to be the all important point. The antrum is kept open as long the ear continues to drain.

In the cases operated upon during the 1929-30 period at the St. Louis Children's Hospital the above technic was followed because it was felt that in curetting out the antrum lining and granulations one of nature's barriers was being removed. In the infants in which the antrum lining was curetted away the discharge from the middle ear continued longer than in cases where a simple opening of the antrum and uncapping of the cells was done.

The gauze or rubber dam drain is removed the fourth day, and following this the complete dressing is changed daily. At each dressing it is most important that rules of strict asepsis be observed. It seems most probable that it is secondary infection that prolongs the convalescent period.

It has been the rule to use a sterile gown and gloves on each case dressed, and even then it was impossible to prevent secondary infections.

In some cases where the discharge from the middle ear persists it may be necessary to remove a mass of infected pharyngeal tonsil. In all infants with infected middle ears and mastoids there

is a varying amount of infection in the nasal sinuses, and the routine use of a 5 per cent solution of some protein silver preparation in the nose is advisable.

During the winter and spring of 1930, at the St. Louis Children's Hospital, twenty-one mastoid operations were performed on thirteen infants. There were two deaths in this series. The age of the infants operated upon ranged from ten weeks to eleven months. Eight had bilateral involvement, four had left side and one right side. The organism found in cultures from the mastoid antrums was usually hemolytic streptococcus. In two instances nonhemolytic streptococcus, in one the staphylococcus aureus and in one the pneumococcus type 3. In only one-half of these cases were the gastrointestinal symptoms predominant, and all of this class recovered where the operation was performed early. Death occurred in the two cases where gastrointestinal symptoms and dehydration had been noted for four weeks prior to operation. Two deaths occurred in nonoperated cases with marked gastrointestinal symptoms, and also with positive ear findings.

One nonoperated case, age 10 weeks, was sent in with a history of diarrhea, vomiting and loss of weight for a period of six weeks, but no record of examination of ears was made during this time. Both tympanic membranes were bulging and, when incised, pus was found in the middle ear. An operation on the mastoids at this time would, in all probability, have hastened the end. Autopsy in this case revealed a bilateral mastoid infection and also a bilateral sigmoid sinus thrombosis.

The history of the second nonoperated case was almost identical with that given above, and the autopsy findings differed in that there was no thrombosis of the sigmoid sinuses.

SUMMARY.

Included in this paper are reports from observers in every section of this country and Europe, and with few exceptions the impression has been that the so-called gastrointestinal-mastoiditis syndrome in infants does exist.

The most important objective findings are in the ear drum and canal. The most often recorded are: drab or gray drum with loss of normal luster, fullness of Shrapnel's membrane, a sagging

of the posterosuperior canal wall, obliteration of normal landmarks, and in many cases a well developed suppurative otitis media is found at the first examination. Postauricular changes are most unusual.

All infants with a severe gastrointestinal disturbance should have repeated ear examinations by a trained otologist. There is less danger to hearing in postauricular drainage than there is in often repeated myringotomies.

No mastoid should be operated upon unless there are definite objective findings in the middle ear and tympanic membrane. The surgical treatment should be done as rapidly as possible, and nature's attempt at repair should not be hindered by curetting away mucous membrane from the antrum. In view of the anatomic conditions found in the infant's ear: relatively large eustachian tube, the presence in the nasopharynx of infective material and the position assumed for almost twenty-four hours a day, is it not reasonable to deduce that a middle ear and mastoid infection would be the most probable condition produced? Regardless of whether the middle ear and mastoid infection is coincidental with or the etiologic factor in gastrointestinal disturbances, it is a most important factor in the final outcome of the case.

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LXXXIX

ENDOTRACHEAL ANESTHESIA: A NEW TECHNIC.*

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The method of anesthesia herein described is employed in operations about the head and neck. It is especially effective in surgery of the mouth and nose.

We have used this technic since 1928.¹ It involves closing the trachea just below the vocal cords with an inflatable cuff placed over an endotracheal catheter, and the application of Waters' carbon dioxide absorption technic of anesthesia.

The catheters employed are of sizes 26, 28 and 30 French. We have not used this technic in any patient under nine years of age.

The cuff consists of two pieces of Penrose rubber tubing, one of which is one-fourth inch and the other one-half inch in diameter, both two inches in length. These are placed one inside of the other and their ends cemented together. A No. 8 French soft rubber catheter is cemented into the end of the cuff and serves as the inflation tube. The cuff is slipped over the end of the catheter so that one-half inch of the catheter protrudes. (Fig. 1.)

We employ the following technic, although there are a number of variations possible. The patient is anesthetized with nitrous oxide or ethylene by an entirely closed method, the carbon dioxide of expiration being allowed to accumulate within the breathing bag. With gas anesthesia established, ether vapor is carried rap-

*Acknowledgment is expressed for aid in the development of the clinical application of this method, Waters to the surgical staff of the University of Wisconsin Medical School; Guedel to Howard L. Updegraff, M. D., of Hollywood, California.

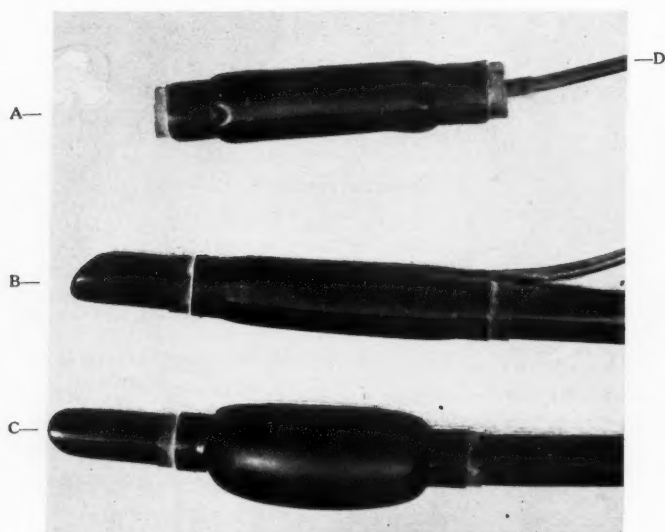


Fig. 1.

- A. Rubber cuff detached, uninflated.
- B. Cuff attached to catheter, uninflated.
- C. Cuff attached, inflated.
- D. Inflation tube.

idly into the mixture for a period of from six to ten minutes or until early ether anesthesia is well along. At this point carbon dioxide is added to the mixture in an amount approximating 10 per cent. Following the addition of carbon dioxide the character of respiration changes rapidly from hyperpnoea to a nearly complete respiratory arrest. Here the mask is removed, after which the apnoea continues for a period of from twenty to forty seconds. During this apnoeic period the vocal cords are widely separated and do not exhibit their opening and closing movements with the slight respiratory excursions present. (Fig. 2.) With the return of normal respiration the cords assume their normal activity. During this apnoea the anesthesia lies in the upper half of the surgical stage. In this state, with the jaw and throat muscles relaxed and the vocal cords widely separated, the catheter

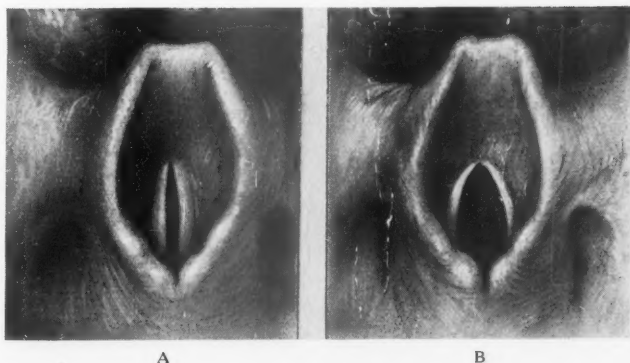


Fig. 2. Vocal Cords.

- A. During apnoea under ether anesthesia with blood carbon dioxide normal or below normal.
B. During apnoea under ether anesthesia with blood carbon dioxide much above normal.

with cuff deflated is introduced through a direct vision laryngoscope, so that the upper border of the cuff lies just beneath the vocal cords. (Fig. 3.) The anesthesia apparatus, now with a soda-lime cannister for carbon dioxide absorption in place, is connected with the catheter. The cuff is then inflated.

Inflation of the cuff is accomplished by injecting air from a ten cubic centimeter ground glass syringe through the small inflation tube. The degree of inflation is determined by the sense of pressure within the syringe. Inflation is carried to a point at which the outside wall of the cuff lightly but firmly contacts the wall of the trachea. Under-inflation will permit leakage between the cuff and the tracheal wall. Over-inflation will produce tracheal soreness lasting from twelve to twenty-four hours. The quantity of air required is from four to ten cubic centimeters. It is interesting to note that with advancing age the required quantity of air increases proportionately, regardless of the physical type of the patient.

In acquiring the sense of proper inflation, we suggest practice with a cuffed catheter, first within a five-eighths inch glass test

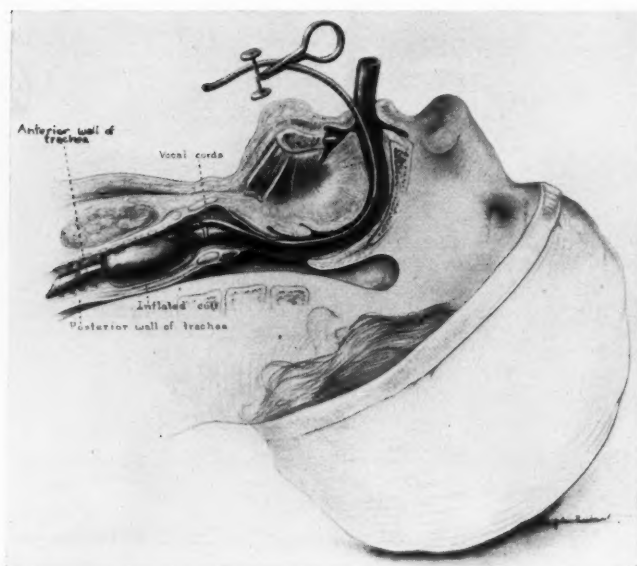


Fig. 3.

Endotracheal catheter in place with cuff inflated. Note position of cuff with relation to vocal cords and compression of esophagus against the vertebrae.

tube, where the degree of inflation can be seen, after which more practice with a freshly removed trachea of a lamb.

Maintenance of anesthesia after the catheter is in place rests upon the principles of carbon dioxide absorption anesthesia technic (Waters³). Briefly, this is as follows.

Anesthesia presupposes a proper saturation of the blood with the anesthetic agent. Neither nitrous oxide nor ethylene are destroyed within the body. They must be eliminated through the lungs. Therefore anesthesia, once established, is maintained without the addition of more gases, so long as the escape of those gases present in the body be prevented. The continuous administration of oxygen to satisfy body metabolism is necessary. This varies in amount between 200 and 800 cubic centimeters per



Fig. 4.

Wire gauge over breathing bag. Soda-lime canister in position.

minute. The expired carbon dioxide is absorbed by soda-lime granules.

The gases inspired are warm and moist. The warmth is due to heating of the soda-lime by its absorption activity, and to the retention of body heat otherwise lost through expiration. After twenty minutes of anesthesia the gas temperature ranges between 100 and 104°.F. The moisture is that of expiration retained within the breathing bag.

For the proper regulation of oxygen flow we employ a stationary gauge, placed over the breathing bag. (Fig. 4.) If more oxygen is admitted than the patient can utilize, the bag fills and approaches the gauge. If insufficient oxygen is admitted, the bag falls away from the gauge. These bag fluctuations are manifest before there is clinical evidence of incorrect oxygen flow. With the bag in constant relationship with the gauge, anesthesia is constant, provided there are no leaks in the apparatus.

The closing technic is important. After the operation is finished, the mouth and pharynx are cleansed of accumulated debris. This is accomplished by irrigation with water or saline solution.



Fig. 5.

Showing irrigation of mouth and pharynx. The irrigation solution in this case is milky for photographic purposes.

(Fig. 5.) With the pharynx clean, the anesthetic apparatus is disconnected from the catheter and the patient allowed to emerge to the point of return of the swallowing reflex, at which time the laryngeal reflex is active. The cuff is deflated and the catheter withdrawn at the crest of inspiration.

Although many patients have retched, with the inflated cuff in place, but two or three cases have succeeded in forcing vomitus into the pharynx, and in these the amount in each case was less than one ounce. On the other hand, with light anesthesia, such as sometimes occurs during the irrigation process, the patient may with effort swallow some of the irrigation fluid. The mechanical obstacle to both the swallowing and vomiting act seemingly lies in the compression of the esophagus against the bodies of the vertebræ by the cuff. (Fig. 3.)

The purposes of this technic are to prevent aspiration of operative débris into the lungs and to provide a clear field of work

for the surgeon. We have found it nicely applicable in adult tonsillectomy when for any reason general anesthesia must be employed.

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XC.

ACUTE GENERALIZED BRONCHIOLECTASIS WITH
BULLOUS EMPHYSEMA.

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Acute generalized bronchiolectasis is of interest to the laryngologist and bronchoscopist because its history and clinical findings may closely simulate those of a foreign body in the lower air passages.

The honeycomb lung is usually discovered at autopsy and is apparently a distinct pathologic entity. It arises under circumstances comparable with those found in bronchiectasis except that it does not occur in the adult and in its extreme generalized form is uniformly fatal. There are no cases on record in which a correct diagnosis was made preceding the postmortem examination.

Dilatations of the bronchi and bronchioles were first noted by Professor Cayol in 1808. At that time he was a student working with Laennec,¹ who published articles describing the clinical and pathologic characteristics of bronchiectasis. Since that time the literature has been rich in treatises on the subject of bronchiectasis but only rare mention has been accorded cases of acute generalized bronchiolectasis with or without bullous emphysema.

Report of a patient with acute generalized bronchiolectasis with bullous emphysema: Robert D., age two, was admitted to the University of Michigan Hospital on January 3, 1930. The referring physician was of the opinion that the child had aspirated a foreign body. The chief complaint given by the child's parents was difficulty in breathing.

The onset of the present illness was as follows: On December 26, 1929, eight days before admission, the child suddenly stumbled and fell. He became very cyanotic and developed marked difficulty in breathing with a distinct expiratory grunt. There was no coughing or choking, but the labored breathing, cyanosis and

expiratory grunt became continuous and were aggravated by the slightest exertion. Although the child had a very poor appetite, there was apparently no difficulty in swallowing.

The past history was not remarkable except for crying spells, which he had been subject to since birth. These came on about twice a week, when he would cry continuously for half a day at a time. However, they were never associated with dyspnea or cyanosis. He was the second child in the family, delivered at full term without incident.* He had been an exceptionally healthy baby with none of the usual childhood diseases. The mother was positive in her belief that he had never had measles, whooping cough or pneumonia, diseases which are commonly associated with dilatations of the bronchi. Six months before admission he had a seizure which the mother described as a "spasm." The attending physician had attributed the "spasm" to a very high fever. The cause of this fever could not be determined.

The family history indicated a tendency towards hyperthyroidism on the maternal side but was otherwise of no importance. There was no history of cancer, tuberculosis or syphilis.

Examination of the child showed him to be well nourished but slightly cyanotic. He was suffering from respiratory difficulty, as evidenced by retraction of the epigastrium and intercostal spaces and a definite expiratory grunt. The head and neck were negative with no signs of inflammation in the upper respiratory tract. The thyroid gland was not palpable.

The chest was normal in shape and contour, except for retraction of the epigastrium and intercostal spaces. Percussion note over the chest was hyper-resonant throughout. The breath sounds were suppressed and distant, and were heard much better during inspiration than expiration. The heart was not enlarged and no murmurs were audible.

Examination of the abdomen, genitalia, extremities and reflexes was negative. The intradermal tuberculin test, urine examination and Kahn test on the blood were also negative. The white blood cell count was 15,000, with no change in the morphology of the cells. A red blood cell count was not taken, but the hemoglobin by the Sahli method was 85 per cent.

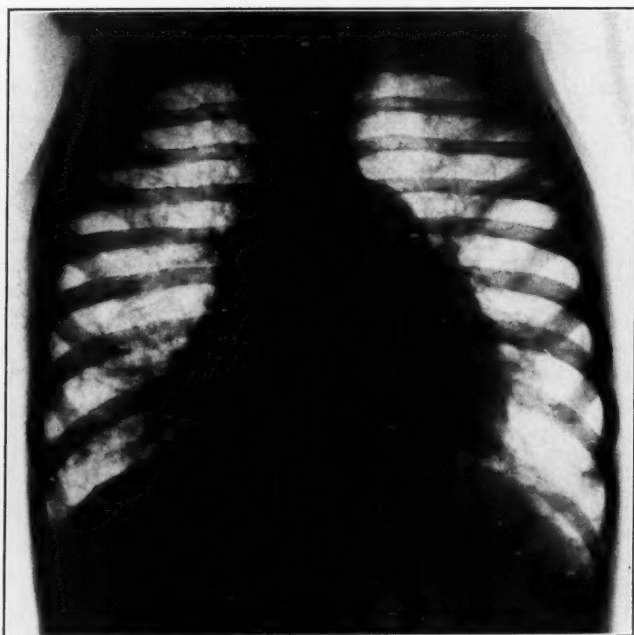


Fig. 1. Anterior-posterior roentgenogram of the chest taken the day before death, showing enlargement of the right side of the heart and circular shadows through both lung fields. There is very little evidence of chronic bronchial inflammation.

X-ray examination of the chest with the fluoroscope and films revealed no evidence of an opaque foreign body in the lungs. Films taken during inspiration and expiration showed none of the characteristic roentgenologic features of a non-opaque foreign body in a bronchus. Over-aeration of both lung fields and the low position of the diaphragm suggested an obstruction to expiration above the bifurcation of the trachea, but careful examination of the tracheal shadow demonstrated no obstruction. Dr. Preston M. Hickey, late of University Hospital, reported curious shadows at both bases which he thought might represent areas of bullous emphysema. (Figs. 1 and 2.)

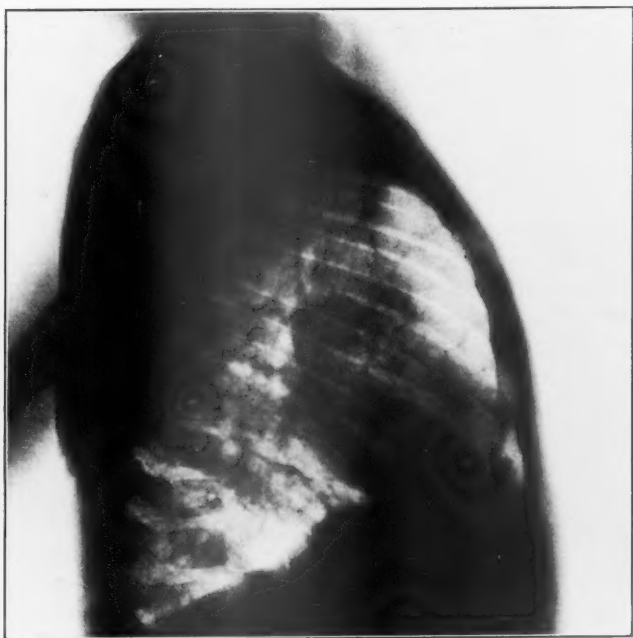


Fig. 2. Lateral view of the chest demonstrating the low position of the diaphragm and the generalized cavity formation.

The child was admitted to the hospital and allowed to rest over night in an oxygen tent. His temperature during the night remained about 99 degrees F. (rectal temperature), pulse 130 and respirations 45 per minute. In the morning his condition was unchanged except for a perceptible increase in the cyanosis.

A bronchoscopic examination seemed imperative, since we did not feel that the presence of a pulmonary foreign body had been entirely ruled out. Without anesthesia, a bronchoscope was introduced perorally into the trachea but was promptly removed when during instrumentation the patient ceased to breathe. Artificial respiration restored the respiratory function but further examination was not attempted at that time.

The following day a bronchoscope was again introduced perorally by Dr. A. C. Furstenberg, and a very unusual and striking condition noted. The primary and secondary bronchi were partially occluded by edematous reddened mucosa and a slight amount of tenacious mucopurulent discharge. After removing this discharge by aspiration, a most extraordinary collapse of the bronchi could be observed. Coincident with the expiratory period, the primary bronchi were rapidly compressed in the anterior posterior plane until at the end of the expiratory phase they were completely obliterated. At the onset of the inspiratory phase the lumina again appeared, only to disappear with the next expiration. This phenomenon was more pronounced in the right primary bronchus than in the left. A foreign body could not be found.

Despite the lack of X-ray evidence of an enlarged thymus gland, the patient was given the maximum therapeutic X-ray irradiation over the thymus. This produced no change in his condition. A continuous oxygen tent regime was again employed under special nursing care. Small feedings were given at frequent intervals; adrenalin and atropin were tried, but with no effect. Oxygen inhalation appeared to be the only treatment of value, but its effect on the cyanosis gradually diminished. Chest X-rays were taken at frequent intervals, but they gave no additional information except that the bullous emphysema seemed to be increasing. X-ray examination of the cervical and thoracic spine revealed no pathologic changes which could account for the bronchial collapse.

On January 17, 1930, two weeks after admission and twenty-two days after the onset of the illness, the child's temperature rose to 102 degrees F. (rectal), the first elevation above 99 degrees F. His pulse averaged 150 and respirations 60 per minute. His condition was gradually becoming more desperate, with increased expiratory difficulty and more pronounced continuous cyanosis upon which oxygen had little effect.

January 23, blood was collected under oil and its oxygen capacity found to be 21.0 volumes per cent. On January 24, the oxygen content of the blood was 16.4 volumes per cent and the carbon dioxide combining power 58.9 volumes per cent. An at-

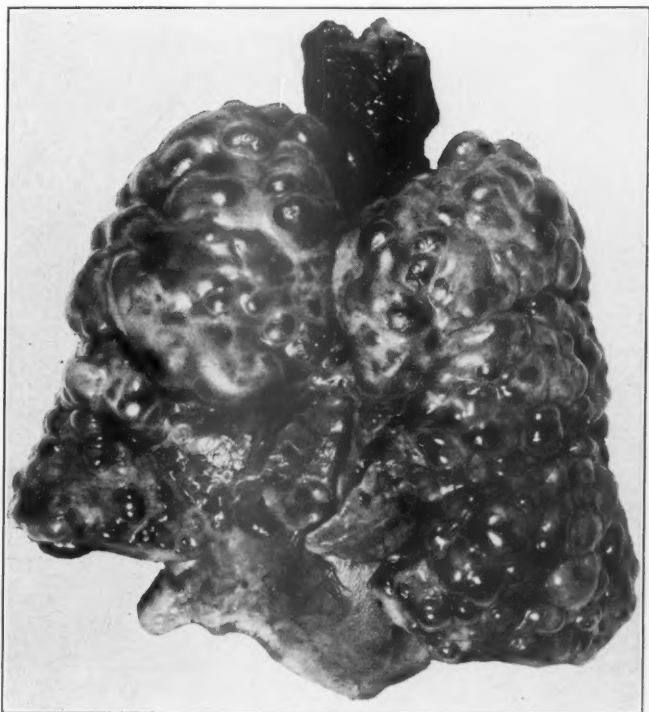


Fig. 3. Photograph of the lungs taken at autopsy showing the surfaces of both lungs studded with distended air sacs.

tempt was made to determine the carbon dioxide tension of the alveolar air, but since the child was in extremis it had to be abandoned.

During the week preceding death, the child's restlessness and fretfulness disappeared, and he lay quietly in his crib, apparently using all of his energy for the difficult task of breathing.

On January 24, 1930, thirty days after the onset of symptoms, respirations ceased.

At autopsy, marked cyanosis was noted, particularly over the head, neck and upper thorax, with numerous petechial hemor-

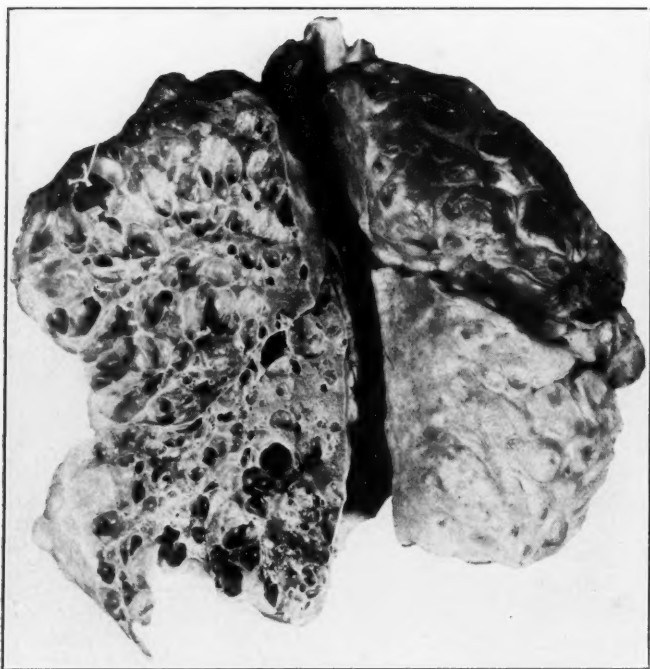


Fig. 4. Photograph taken after the lungs had been hardened in formalin but still showing the labyrinth of dilated alveoli and bronchioles.

rhages in the skin of these regions and also in both inguinal regions. There was marked engorgement of the superficial veins of the neck.

The lungs were extremely voluminous, showing a remarkable degree of symmetrical generalized bullous emphysema. Both lungs were riddled with cystic spaces varying in size from one millimeter or less in diameter to one and a half centimeters. Many of these appeared continuous with the smaller bronchi. The largest spaces were found anteriorly. More lung tissue remained posteriorly, but this appeared to be definitely fibrotic. (Figs. 3 and 4.)

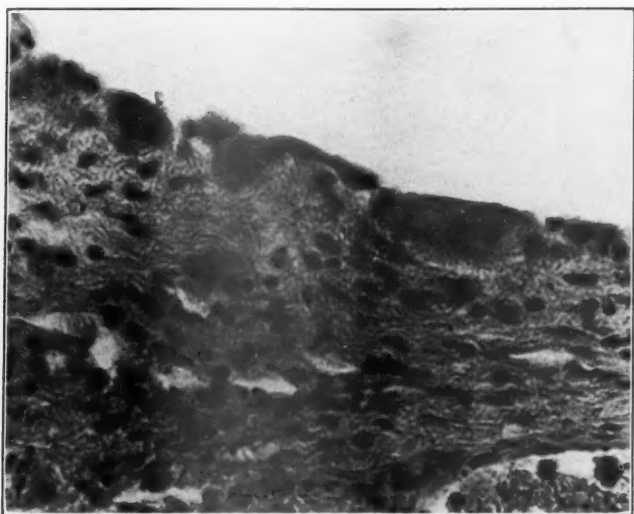


Fig. 5. Microphotograph of the wall of one of the dilated alveoli lined by foreign body giant cells.

Both primary and secondary bronchi had a somewhat oval cross section. The cartilages were soft but not to a pathologic degree, considering the age of the patient. Inspection of the bronchi with relation to the surrounding parenchymatous tissue showed that the emphysematous lung folded both posteriorly and anteriorly, and had apparently compressed the bronchi, giving in effect a partial stenosis of all the secondary bronchi.

Gross examination revealed no tubercles in the lungs. There was a marked cardiac dilatation with venous stasis, subepicardial and pericardial petechial hemorrhages. These findings, coupled with the cyanosis and petechial hemorrhages in the skin, pointed towards a suffocative death.

The microscopic examination of the lungs by the late Dr. Aldred Scott Warthin was of extraordinary interest. The sections showed a dilatation of many bronchioles with the production of cysts, most of which were lined by foreign body giant cells. (Fig. 5.) All stages of dilatation were present. The smaller

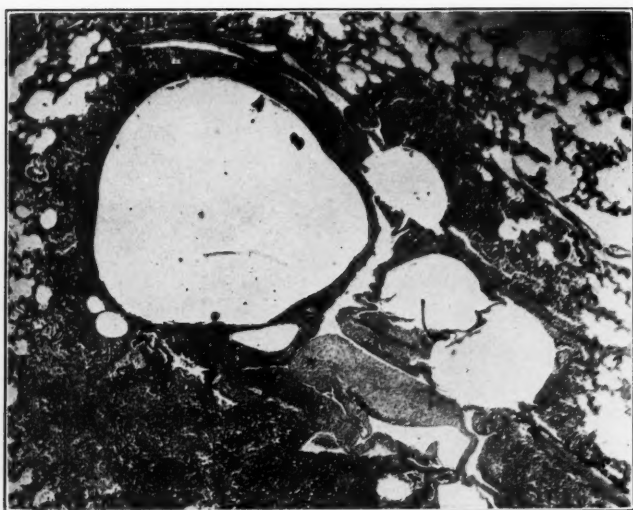


Fig. 6. Section showing several small cystic cavities surrounded by atelectatic and inflamed lung tissue.

bronchi as well as those of the main divisions were affected. There were many bronchioles and bronchi which were not involved, and these in most instances were quite normal. Surrounding the cystic spaces there was atelectatic and inflamed lung tissue with numerous phagocytes containing hemosiderin and desquamated alveolar epithelium. (Fig. 6.) Between the cyst spaces there was considerable lung tissue which was only moderately dilated and appeared fairly normal. In other areas, it presented the appearance of a chronic purulent pneumonia with beginning organization. Some of the cyst spaces had developed fibrous connective tissue in their walls, and in the pneumonic areas there was some evidence of regeneration of alveolar epithelium in the form of cells of Tripier. The yellow elastic tissue stain did not seem to show any divergence from the normal.

The bronchial nodes were hyperplastic with exhausted germ centers. The thymus gland showed X-ray atrophy and hyaline

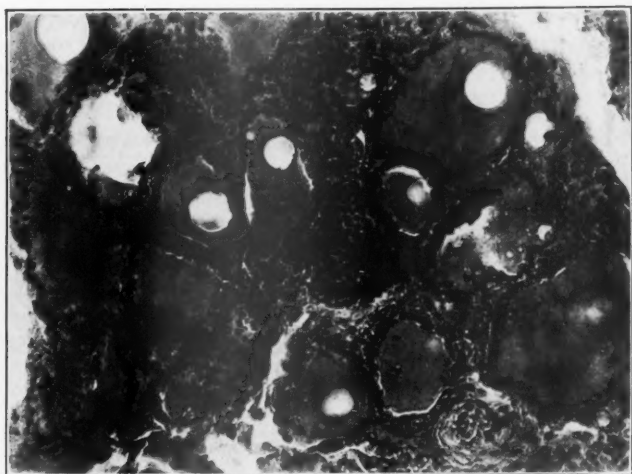


Fig. 7. Microphotograph of a section through the thyroid gland showing an increase of colloid excessive for the age of the patient and an infiltrating atypical adenoma, histologically malignant.

fibrosis. Very few of Hassal's corpuscles were left and these were mostly calcareous.

Microscopic examination of the thyroid gland presented a most interesting feature. There was abundant colloid, an increase which was excessive for the age of the patient. Nearly half of one lobe was replaced by an atypical adenoma which histologically showed malignancy; an early undifferentiated cell carcinoma. The neoplasm was not differentiated from the surrounding thyroid tissue but was infiltrating with no evidence of encapsulation. (Fig. 7.)

Tissues from other organs were not unusual, so need not be recorded. The final pathologic diagnosis was summarized by the late Dr. Warthin as follows: Bilateral cystic bronchiectasis and bronchiolectasis with bullous emphysema. Chronic purulent lobular pneumonia. Death from asphyxia as shown by the marked cyanosis of the head, neck and chest, and the presence of many petechial hemorrhages with cardiac dilatation and marked venous

stasis. Thymicolymphatic constitution shown by a hyperplastic thymus with X-ray reduction, generalized lymphoid hyperplasia and hypoplasia of the aorta and adrenals. Malignant adenoma and an undifferentiated carcinoma of the thyroid. Atrophy, passive congestion and slight parenchymatous change of all organs.

A few similar cases have been reported in the medical literature; some under the title of bullous emphysema, others as cystic bronchitis and a few under the classification of generalized or universal bronchiolectasis proposed by Dr. William Ewart.² It is reasonable to suppose that most of the cases of bullous emphysema also had some dilatation of the bronchioles. This must of necessity be true where a definite communication with the bronchi could be established. It is possible that those cases of generalized acute bronchiolectasis in which emphysema of the bullous type was not observed would, under certain circumstances, have gone on to the formation of emphysema. The bullous emphysema would seem to be an advanced stage of acute bronchiolectasis arising as a result of progressive mechanical and pathologic factors.

The etiology of dilatations of the bronchi has been of interest to many investigators, judging from the great mass of literature on the subject. Most authors have used cases of bronchiectasis to illustrate their theories. As acute bronchiolectasis is similar in many respects and seems to be a distinct type or advanced stage of bronchiectasis, their conclusions are of considerable interest.

Laennec,¹ in 1819, first advanced the so-called inspiratory theory. He believed "that the air drawn into the lungs in inspiration was retained, being unable to escape during expiration, owing to the obstruction caused either by catarrhal swelling of the mucous membrane of the bronchi or by the accumulation of mucus in the tubes; and that as a consequence the lungs became over-distended with air."

From 1819 to 1845, many investigators suggested explanations for the occurrence of dilated bronchi and emphysema of the lungs. Detailed enumeration of their opinions is not of importance, as their various theories often overlapped and in nearly every case

merely augmented the gradually increasing knowledge concerning these conditions. Mendelssohn,³ in 1845, first suggested the plausible expiratory hypothesis, but it remained for Sir William Jenner,⁴ in 1857, to express this theory in concrete terms. He pointed out that "the lung during expiration is compressed at different parts with different degrees of force. The parietes of the thorax in consequence of their anatomic constitution yield to the same force at different parts with various degrees of facility. The chosen seats of emphysema are exactly those parts of the lung which are least compressed during expiration and which are situated under those portions of the thoracic parietes that give way the most readily before pressure."

This expiratory theory has been generally adopted as the logical mechanical explanation for bronchial dilatation and emphysema. Mechanics alone, however, cannot explain dilatation as long as all parts of the lower respiratory tract are functioning properly.

As stated so capably by William Ewart:² "The range of pressure to which it (the bronchial membrane) is exposed is not so great, but the risk is multiplied by the number of subordinate districts. A loss of the even balance between the intra- and the extra-bronchial pressure occasioned by imperfect inflation might in delicate and predisposed subjects cause the bronchial wall to yield to progressive dilatation."

Among the pathologic factors which have preceded and accompanied dilatations of the bronchi and emphysema, pneumonia of the lobar, pleuro and bronchial type has been the most common. Bronchitis, pleuritis, tuberculosis, asthma, cough, influenza, measles and whooping cough have been frequently mentioned, and in a few instances the dilatations have apparently been due to some temporary or permanent obstruction of the bronchi by a foreign body, aneurism of the aorta or enlarged mediastinal glands.

Since we are primarily interested in a distinct subdivision of the broad classification of bronchial dilatation, it will be adequate to discuss this particular type of case from the viewpoint of history, clinical examination and pathologic findings and refer those further interested to the excellent and most exhaustive treatise on bronchial dilatation by William Ewart.²

The history in these acute generalized forms of bronchiolectasis is so meager and death occurs so soon after important symptoms appear that it is impossible to find any case reports in the literature where the correct diagnosis was made previous to the postmortem examination. In fact, most of the cases of this type have been reported from the pathologic point of view without the record of a clinical history.

Andral⁵ reported several cases in 1823, but did not refer to the history. Dr. Sharkey's⁶ first patient, 1892, gave no history of previous illness except measles. The period which elapsed between the measles and the child's fatal illness was not recorded. His second patient, age 4, was observed from May 7 to June 10, 1893. This child developed a cough productive of thick phlegm two months before admission and had been vomiting three and four times a day. Emile Sergent,⁷ in 1904, cited several cases which he believed had followed measles and whooping cough, but gave very few details. Emery and Langmead,⁸ 1910, reported a patient, four years of age. This boy died six days after the onset of symptoms. Postmortem examination suggested that the honeycomb lung had been due to pneumonia, but as in most of the other cases this could not be verified by the history or clinical findings. Barlow⁹ reported a patient in 1923. The child, two years and seven months of age, had been normal until the age of ten months. At that time he had contracted whooping cough which had been followed by heavy breathing and cyanosis. This condition had persisted until a few hours before death, when the child was rushed to the hospital in extremis.

Our patient was no exception in having a meager history. He had always been an exceptionally healthy child. There was no history of measles, whooping cough, influenza or pneumonia, and he had had none of the usual childhood diseases. The "spasm" six months before admission must, I believe, remain a mystery, since the family could give us no information regarding this seizure except that it had been accompanied by a high fever. Obviously this could have been due to a pneumonia, although the child did not cough or raise any sputum. His prolonged crying may have had some bearing on the illness, since it is conceivable that during these spells the forced exertion was pro-

ducing more and more dilatation of his bronchioles and alveoli. The onset of symptoms, however, was abrupt. Five days before admission, without warning, the child fell over while playing quietly on the floor, developed marked difficulty in breathing, and became very cyanotic. Neither coughing nor choking was observed. He entered the hospital in extremis with a tentative diagnosis of a foreign body in the lower air passages.

The recorded clinical findings have also been meager in most of the cases. Dr. Sharkey's⁸ second patient presented a dusky flush, rapid breathing, no marked dullness on percussion, no tubular breathing but crepitations over the lung fields on both sides. The pulse rate was 136, temperature 102.6, with respirations 44 per minute. Twenty-seven days after the onset of symptoms subcutaneous emphysema occurred. X-ray reports were not mentioned.

Dr. Barlow's⁹ patient was admitted in extremis, showing breathlessness, cyanosis and a rapid, weak, irregular pulse. The temperature was 36.4 degrees C., pulse 180 and respiratory rate 60. The chest position was limited as in severe asthmatic attacks.

Clinical examination in our patient revealed the following interesting features: Slight cyanosis, respiratory difficulty shown by the retraction of the intercostal spaces and the epigastrium and an expiratory grunt. Percussion over the chest gave a hyperresonant note throughout. The breath sounds were suppressed and distant, being heard better on inspiration than on expiration. The temperature was about 99 degrees F. (by rectum) throughout most of the illness, pulse 130 and respirations 45 per minute. Late in the course of the disease the temperature rose to 102 degrees and respirations gradually accelerated to 60 per minute.

X-ray examination of the chest showed over-aeration of both lungs with curious shadows, circular in outline, which represented the cystic spaces found at autopsy. The diaphragm occupied an unusually low position on both sides. Bronchoscopy demonstrated an extensive mucopurulent bronchitis and an anterior posterior collapse of the primary bronchi with every forced expiration. Oxygen had very little effect on the child's cyanosis. The oxygen capacity and content of the blood and the carbon dioxide combining power of the blood were within normal limits.

From the pathologic point of view, the previously reported cases of bronchiolectasis and bullous emphysema have been prolific. As in all advanced cases of emphysema, when the thorax is opened the lungs fail to collapse and remain fully distended with the diaphragm low.

In the cases with small emphysematous spaces, "the lungs feel like a pillow of down," an expression first applied to them by Laennec. In our patient, as in others with spaces varying in size from a millimeter to one and a half centimeters, the surface of the lungs was studded with rounded elevations. These grape-like elevations are the outer walls of the cystic air containing cavities, and through the taut, distended pleura which covers these peripheral sacs one can see a veritable labyrinth of similar cavities scattered through the parenchyma of the lung. In most cases these cavities will be largest in the anterior part of the chest and will contain a varying amount of purulent discharge.

Compression of the bronchi by the emphysematous lung tissue folds was perhaps the most interesting observation in our patient. This compression was observed clinically during a bronchoscopic search for a foreign body. The demonstration of bullous emphysema in the chest films offered an explanation for the mechanics of this phenomenon before the lungs were examined at autopsy.

During each forced expiratory effort alveolar air, in following the course of least resistance, passed out into the large cavities around the periphery of the lung instead of escaping through the constricted bronchi. The increase of pressure in these cavities, resulting from contraction of the powerful expiratory muscles, gradually distended them and obliterated the neighboring lung tissue. Because of the cystic character of the lung folds anterior and posterior to the primary bronchi, inflation of these spaces caused pressure on the already infected bronchi and resulted in their temporary collapse. New cystic spaces developed until, as in the cases described by Miller,¹⁵ the greatly distended alveoli by their fusion gave rise to bullæ which projected beyond the level of the surrounding pleura.

A vicious circle was established. Compression of the bronchi increased with the enlargement of the spaces and the alveolar air

met increasing difficulty in escaping anywhere except into the peripheral sacs.

If we assume the presence of cystic spaces and of bronchi which are partially occluded by tenacious mucus and edematous lining, the progress of such a condition is easily explained. The manner in which such a situation arises, in a brief period of time and without important symptoms remains rather baffling. A number of authors have offered various explanations for the cause of these dilated bronchi, bronchioles and alveoli. In 1908, Thornton and Pratt¹⁰ conducted some interesting experiments on "The Relation of Bronchial Stenosis to Bronchiectasis." They constructed an artificial thorax by suspending the lungs and trachea of a dog in a glass Bell jar with the lower end closed by a rubber membrane which represented the diaphragm. Each bronchus was connected to a tambour. Using this apparatus they tested the theory that inflammatory changes in the bronchial walls and stenosis of the bronchi were the chief etiologic factors in bronchiectasis. They found that without occlusion of the bronchi there was a slight negative pressure on inspiration and an equal but positive pressure on expiration. With one bronchus partially occluded, both the positive and negative pressures were increased in their respective phases. Both phases were so prolonged that no opportunity was given for the usual pause between inspiration and expiration. The lung on the partially occluded side failing to completely retract, remained partially distended and constantly approximated the inspiratory position. These observers also concluded that any interference with the elasticity of the lung altered expiration, weakened the walls and permitted distension.

Thus we find that the partially occluded bronchus may act as a ball valve, allowing air to enter the chest but offering firm resistance to its escape. Yet with subordinate districts which do their share of the work, it is doubtful if dilatations would occur. This lack of co-operation of parts or all of the parenchyma of the lung is commonly associated with pneumonia and bronchopneumonia where the dilatations which result are secondary and compensatory to collapse of other areas of lung tissue.

Occasionally some disease, such as measles, syphilis or tuberculosis is responsible for the weakening of the lung parenchyma.

Sir Dominic Corrigan,¹¹ in 1842, believed that nonresolution of pneumonia, syphilis and chronic bronchitis lead to fibrosis of the lung tissue with traction on the bronchial walls sufficient to produce dilatation.

Sir T. Grainger Stewart,¹² in 1867, expressed the view that a large proportion of the cases of bronchiectasis were due to a constitutional or hereditary weakness of the bronchial walls. Thus the bronchi were rendered unfit for the stress, even within physiologic limits, of powerful respiratory efforts of cough and violent exercise.

Dr. Alfred Scott Warthin viewed dilatation of the bronchi and alveoli as a common sequela of the healing process of white pneumonia or congenital syphilis. He suggested muconium pneumonia, which may develop years after birth, as shown by the encapsulation of lanugo hairs in the giant cells which line the cystic spaces, as a potential cause of acute generalized bronchiolectasis. The giant cells which are invariably found in the lining membrane of the cystic spaces arise from the irritation of imprisoned gas. Beneke¹³ of Jena, in 1913, found in one patient that the bullæ were under 300 mms. of mercury pressure and that upon chemical analysis the contained gas was pure nitrogen and carbon dioxide.

The poor ventilation of the periphery of the lung, due to the increasing difficulty of the inspired air to reach the alveoli, most of which have been rendered useless by the process of dilatation or collapse, results in gradual exhaustion of the oxygen content. The carbon dioxide content of the alveolar air is consequently elevated until it equals that of the blood and tissues, and the patient succumbs to suffocation.

Experimental production of dilated bronchi in rats was achieved by the injection of micrococci proliferans obtained from infected carcinomatous lesions. Thiroloix and Debre,¹⁴ who conducted these experiments in 1908, found cystic spaces in the lung surrounded by areas of white pneumonia. They concluded that the pneumonic process favored the production of dilatations. In all of their experiments the lining of cystic spaces was found to contain many giant cells, and adjoining tissues were often infiltrated with large numbers of them. They were especially numerous where epithelium was proliferating and desquamating. The ex-

pansion of the epithelium was directly proportional to the friability of the hepatized pulmonary parenchyma.

It is quite apparent after studying the literature and carefully considering the autopsy findings in this patient that pneumonia is the predominating factor in paving the way for dilatations. An extensive peribronchitis of the infiltrating or necrotic type with a loss of the bronchial elastic tissue and an invasion of the muscle circle by inflammatory elements has been a common finding in most of these cases. This is especially important when the weakening of the bronchial walls and peribronchial tissue is accompanied by a bronchial stenosis. Given these two pathologic conditions, the stage is set for the production of dilatations of the bronchi, bronchioles and alveoli.

It is doubtless true that in most cases the process becomes arrested in the early stages. In the congenitally susceptible patients, where the pulmonary changes progress as the result of the pathologic and mechanical factors above mentioned, death from suffocation ensues. At autopsy a generalized bronchiolectasis with bullous emphysema is observed.

METROPOLITAN BLDG.

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XCI.

PROGRESSIVE OSTEOMYELITIS OF THE CRANIAL BONES SECONDARY TO SUPPURATIVE NASAL SINUSITIS.*

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Percival Potts, in 1750, noted the clinical association of pericranial and extradural abscess with osteomyelitis of the cranial bones. In 1879, von Bergmann recognized that this was the result of the osteomyelitis. At the 1899 meeting of the British Medical Association, Luc of Paris and Tilley of London, independently, presented a case of osteomyelitis of the skull secondary to nasal sinus disease. These were the first cases recorded that recognized that nasal sinus disease was a factor in the etiology of osteomyelitis of the cranial bones. In 1909, Gerber was able to collect only 29 cases of osteomyelitis due to frontal sinusitis. Dan McKenzie, in 1913, reviewed the literature and collected 45 cases of progressive osteomyelitis secondary to nasal sinus disease. Lemere, in 1922, reviewed the literature subsequent to McKenzie's 1913 article and added 14 cases, making a total of 59 cases at that time. I have reviewed the literature from the latter date up to 1931, noting not only the original articles and discussions, but also including some cases not reported in the literature, and obtained by me from personal communication with the surgeon; these cases make an additional 66 cases which, added to the 59 cases of the McKenzie-Lemere series, make a grand total of 125 cases to date.

Among the predisposing causes, the age of the patient is a very important factor. Osteomyelitis is more prone to develop in diploic rather than in sclerotic bone, and the diploe are further developed in adolescent and early adult life. Schilling demonstrated that in the frontal sinus the diploe are most prominent

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at the superior border, where the outer and inner tables meet, and it is at this point that we find most often the beginning of a progressive osteomyelitis of the frontal bone.

Clinically, we divide the nasal sinusitis osteomyelitis into two etiologic types, the spontaneous and the postoperative. The spontaneous type originates from nasal sinus disease in which no operation on the sinus was done. The nasal sinus disease is most frequently an acute sinusitis, the result of a swimming pool infection, grippe or the "common cold," but it may develop from chronic sinusitis with an exacerbation. The postoperative type follows an operation on an infected nasal sinus. Here we have trauma added as a factor. It occurs most frequently after an operation on the frontal sinus, especially in the presence of an acute infection and in the young. It may occur after an external or an intranasal operation, but is far more frequent after the external operation. Logan Turner states that osteomyelitis followed 12 of 20 external operations and 3 of 8 intranasal operations on the frontal sinus. The interval between a sinus operation and the onset of the osteomyelitis may vary from two weeks to two months. Trauma over a bony covering of an infected sinus may cause an area of diminished local resistance which may be sufficient to bring about an osteomyelitic process. Anatomic-pathologic conditions resulting in insufficiency or absence of drainage, such as swollen mucosa or stricture of the nasofrontal duct which interferes with the drainage of the infected nasal sinus, and insufficient postoperative drainage predispose to increased and progressive infection.

The exciting causes are micro-organisms, the most frequent of which is the staphylococcus pyogenus aureus. Woodward found this organism present in 73 per cent of the cases. The streptococcus and pneumococcus also occur. The degree of severity of the infection depends on the amount of lessened immunity of the tissue and the increased virulence of the infecting organism. Infection of a nasal sinus with micro-organisms, together with an occluded ostium, venous congestion and diminished blood supply produces pus under pressure which results in an area of ulceration of the mucosa and infection and necrosis of bone. A

septic thrombophlebitis of the perforating veins of the sinus extends to involve the communicating veins of the diploe which communicate with the veins of the pericranium and the dura mater. Hence, there results from the spreading of the infection from the diploe, externally, a pericranial (subperiosteal) abscess, and internally, an extradural abscess, while infection of the diploe forms a diploic abscess.

In the diffuse progressive type of osteomyelitis, the frontal bone is most frequently involved. The frontal bone may be involved alone or in association with other cranial bones. The bone is infected either by the continuity of infected bone or by metastasis by means of septic thrombophlebitis. In the latter case the infection is by way of the infected diploic veins and jumps over noninfected areas of bone to produce an area of osteomyelitis surrounded by healthy bone. In this way multiple islands of osteomyelitis may be produced. The soft, doughy swelling or Pott's puffy tumor is caused by the pericranial abscess. The diploic bone may be studded with small abscesses, which may coalesce to form larger abscesses. When the diploe becomes necrotic it is replaced by pus and granulations. The outer table, having the lesser blood supply and being less compact than the inner table, breaks down first and presents a worm-eaten appearance. The hard inner table is the most resistant to infection, although an extradural abscess is usually associated with a pericranial abscess, but this is explained by the intimate connection between the veins of the diploe and the dura. Septic thrombophlebitic vessels are found in the diploe. Sequestration and fistula formation usually involve the outer table and the diploe.

The intracranial complications of progressive osteomyelitis occur as the result of contiguous infection or as the result of infection by metastasis via the dural veins. Extradural abscess is the most frequent complication, after which comes meningitis. Frontal lobe brain abscess occurs occasionally as a complication of frontal bone osteomyelitis.

Septic thrombophlebitis of the superior longitudinal sinus may occur. Eckstein collected six cases and Woodward added another in which it was secondary to sinusitis osteomyelitis.

The clinical course is variable. The onset may be acute and stormy or insidious. The course is frequently associated with periods of storm and calm. The symptoms depend on the course, whether acute or chronic, the sinus involved and the extent of progressive involvement of the cranial bones and, to a lesser degree upon the case being one of spontaneous origin or being secondary to some operative procedure on an infected nasal sinus. As the vast majority of these cases are secondary to osteomyelitis of the frontal bone, we shall limit our discussion of the clinical picture to this region. First, there is the acute fulminating type of acute sinusitis and acute osteomyelitis, with fever, frontal headache, pus in one or both nasal chambers, swelling of the upper eyelid or both lids on the affected side, or bilateral involvement of the upper and lower eyelids, spontaneous pain in the forehead, and exquisite tenderness over the floor or the anterior wall of the frontal sinus. Pathognomonic for osteomyelitis of the frontal bone is the soft doughy swelling of the skin of the forehead which extends from the root of the nose to the hair line and is sensitive to pressure. Fluctuation may be present. This is Pott's puffy tumor, which is a pericranial abscess, and is due to osteomyelitis of the underlying bone. In an acute osteomyelitis associated with a chronic sinusitis we usually obtain a history of chronic nasal sinus disease, and can demonstrate the presence of nasal polypi, bone fistula with purulent discharge and often multiple sinus involvement. In a chronic osteomyelitis associated with a chronic sinusitis, besides the signs of chronic nasal sinus disease, there may be present fistulæ, sequestra and purulent discharge from the bone. In the postoperative type, acute osteomyelitis follows an operation on an infected nasal sinus.

One of the earmarks of a progressive osteomyelitis is its cyclic exacerbation. The recurrence of fever, rapid pulse and leucocytosis after a silent and afebrile period, together with the reappearance, in another location, of a doughy or fluctuant swelling, is almost pathognomonic of an extension and recurrence of the osteomyelitic process. This syndrome should suggest, at once, more roentgenologic studies of the suspicious area. The presence or absence and the location of sequestra may be demon-

strated. The progress of sequestration and the involvement of new areas of bone may be determined. Roentgenograms should be taken, at least monthly, so that we may obtain a chronographical record of the course of the disease. Laboratory aids are important in the diagnosis, treatment and intelligent appraisal of the course of progressive osteomyelitis and its complications. In all cases, if for no other reason than its scientific value, smears and cultures should be made of the pus obtained at operation from the affected nasal sinus and the area of osteomyelitis. Other laboratory tests should be utilized, such as the white blood count, the Wassermann test, the tuberculin test, and the lumbar puncture when an intracranial complication, and a blood culture if septic thrombophlebitis is suspected.

An early diagnosis is essential, but this is sometimes difficult in the cases with an insidious onset. It is here that roentgenology may render valuable aid. In the established and typical case the diagnosis is readily made from the signs and symptoms, together with the roentgenologic findings. The diagnosis requires the establishment of the presence of two distinct pathologic conditions—viz., a suppurative nasal sinus disease and a secondary osteomyelitis which is progressive and diffuse. For diagnostic purposes we may separate the cases into the acute and the chronic. We shall have to differentiate the cases with an acute onset from an acute sinusitis with swelling of the soft parts, associated with periostitis or a subperiosteal abscess, and also from the cases of orbital cellulitis or abscess secondary to nasal sinus disease. The cases with an insidious onset and chronic course will have to be differentiated from a luetic or a tuberculous osteomyelitis. This may not be as easy as it appears, because we may have an osteomyelitis of the cranial bones secondary to nasal sinusitis in a luetic or tuberculous individual. In the luetic or suspected luetic case, the result of an intensive therapeutic test should either prove or disprove the diagnosis, regardless of the history or the serologic test. A tuberculous osteomyelitis may be secondary to a tuberculous nasal sinus disease. The presence of a tuberculous osteomyelitis secondary to nasal sinus disease in an individual in whom no focus of tuberculosis is demonstrable, would be difficult to establish without the finding of tubercles and the tubercle

bacillus in the necrotic bone and pus; an additional aid would be the inoculation of a guinea pig.

Regarding the prognosis, Tilley noted that the mortality is very much higher in the postoperative type than in the spontaneous type of osteomyelitis. According to an analysis of 55 cases collated by Bulson in 1925, 52 per cent of the cases of osteomyelitis occurred after operation on the frontal sinus with a mortality of 79 per cent, and there was a mortality of 54 per cent in the spontaneous cases. McKenzie, in 1927, reported 16 cases in which the mortality in the postoperative cases was 70 per cent and in the spontaneous cases it was 30 per cent.

The type of the infecting micro-organism influences the prognosis. Woodward found that in 14 cases, in which the staphylococcus was the causative organism, the mortality was 21 per cent. The cases that develop intracranial complications have a very high mortality. An extradural abscess, if discovered and drained early, does not materially increase the mortality. The outlook in the acute cases of progressive osteomyelitis is not as good as in the chronic case, as in the latter an immunity has already been established. An early diagnosis and treatment have a more favorable influence on the prognosis. The method of treatment also may affect the prognosis. According to Blair, the radical treatment has a mortality of 65 per cent, while the conservative treatment has a mortality of 35 per cent.

The prophylactic treatment is very important. We should avoid operation, and especially radical operation, in all cases of acute sinusitis. When doing a frontal sinus operation, do not elevate the periosteum over the frontal plate, and avoid opening of the diploe at the superior border of the frontal sinus. On this account, the Jansen or Lynch operation should be preferred to the Killian, as they do not involve this region. If, however, the Killian operation is done, it is best to bevel the bone at the superior border of the frontal sinus and replace the denuded periosteum over it.

The active treatment is surgical and is divided into the radical and conservative treatments. Each has its advocates and both claim good results. According to Grant, the conservative treatment comprises the following: Open and drain pus accumulations

as they appear, make no large incisions, never curette, remove the bone enough to discover the presence or absence of an extradural abscess, remove all sequestra, do not attempt to remove all of the infected bone, let the healthy bone alone, save as much of the inner table as possible as the bone regenerates here, wait for sequestra to form and then do sequestrectomy. Do not go through the dura until you have to; it is better to wait ten days to see if a brain abscess is present or not. In the course of time, the patient develops an immunity which limits the infection.

The radical treatment, according to the method of Esch, consists in making large incisions in order to obtain a wide exposure of the diseased bone. Next, all of the diseased bone is completely removed, beginning in the healthy bone, in order to avoid infection of the healthy bone adjacent to the diseased bone. Even if the lamina interna appears healthy, we must search for an extradural abscess. The anterior and posterior walls of the frontal sinus are removed, but the supra-orbital ridge and the inferior wall are conserved. The wound is left wide open for three or four weeks and packed with vaselin gauze. No sutures are used. Esch reports six cases of progressive osteomyelitis of the frontal bone which he treated in this manner with a mortality of but 33 per cent.

What may be termed the ultra-radical method comprises, in addition to the radical method, a reinforcement against the progressive spread of the infection into the cranial bones, by means of a trench system in the healthy adjacent bone, as performed by Schilling and von Eiken. Schilling cuts a 1 cm. trench out of the healthy bone down to the dura, while von Eiken makes two trenches, a first and a second line of defense; the first trench is cut out of the bone from the fossa temporalis and the second trench from ear to ear.

My own experience in this dreaded disease is limited to two cases of progressive and diffuse osteomyelitis secondary to suppurative frontal sinusitis. The radical treatment, which consisted essentially of the method of Esch, was used in each case and both recovered.

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XCII.

STREPTOTHRIX INFECTIONS OF THE MASTOID, MIDDLE AND EXTERNAL EAR.*

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Streptothrix of the mastoid seems well described under the heading of actinomycosis, though the cases are few in number. The characteristic sulphur-like granules on which the diagnosis rests were not found in the case which aroused our interest, but a thread fungus was repeatedly found in smears from the mastoid and postmortem in the lung and the brain. This was designated *streptothrix*, subgroup undetermined, by the bacteriology department. There seems to be much confusion as to the identification of the subgroups and their nomenclature. As Jordan and Falk state in their text: "In 1877 Harz described the thread fungus in lumpy jaw of cattle as 'actinomycosis' and started the group on its quarrelsome path." Cohn calls them *Streptothrix*. Trevisan suggests *Nocardia* for those forming spores, as distinguished from the nonspore forming actinomycosis. MacCallum, in his text on pathology, p. 586, holds there is no valid reason for separating the *Streptothrix* from the *Actinomyces*, since the former may produce the typical clubs under suitable conditions.

Both act by causing a cell necrosis and leucocytic infiltration, followed in a few weeks by granulation tissue, with a central area of liquid pus and organisms with outer zones of dense fibrous tissue.

This study, therefore, is presented as a *streptothrix* infection of the mastoid. The clinical course and wound appearance were similar to the cases of actinomycosis described in the literature.

Indeed it was thought to be such an infection, but no sulphur granules or club formation were ever demonstrated, so it could not be assigned to the subgroup.

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Streptothrix infection of the middle ear and mastoid is quite rare, though lesions of the head and neck are common. The first case was reported by Ginsberg,¹ in 1890, and the second by Majocchi,² in 1892. Since then but nine cases, with a doubtful tenth, have been reported. There are five other cases, but we were unable to obtain the publications and have not included them in this paper.

There is much speculation as to how the infection reaches the middle ear and mastoid, and there are probably various methods. With such a small number of cases it is difficult to draw definite conclusions. Majocchi² feels that his case was infected via the eustachian tube from the primary focus in the lung. In Zaufal's case, reported by Beck,³ a fistulous tract reached from the left tonsil and terminated in an abscess containing actinomycotic granules, again via the eustachian tube. Urbantschitsch⁴ reports a case in which the primary focus was carious teeth, though no ray fungus was demonstrated around them.

New⁵ believes cases may occur from the use of infected wood, as toothpicks, and cites a case in which a splinter was found in the tongue. He quotes Harms as reporting this in five other cases in man, and Boestroem as demonstrating it in nearly all recent cases in cattle by examining serial sections of the tongue. He also states that Lord has demonstrated the fungus in carious teeth and tonsillar crypts. He notes two cases occurring in the nasopharynx, but does not state whether or not an otitis occurred.

There have been no cases reported of blood or lymph borne infections.

Our case showed no buccal infection, and since it began as an external otitis we believe it may have been caused by scratching the canal or have followed an external otitis from swimming. The middle ear did not discharge nor did the very small portion of the drum which was visible appear abnormal. It is possible that the infection had passed through the middle ear, leaving very little change there, and developed in the mastoid. This may occur in pyogenic infections, but in view of the chronicity of the lesions elsewhere in this case it is most improbable. Riviere and Thevenot⁶ do not admit the probability of a canal infection spreading to the mastoid by extension. They state: "Actinomycosis of the

external ear starts on the concha or in the external auditory canal. The constitution of the region admits of but a cutaneous actinomycosis. The hardness of the tissue and absence of subcutaneous tissue in quantity prevents the fungus developing." Urbantschitsch also states, "Direct infection of the integument is extremely rare; especially is this true for the ears." He also agrees that "Lymphogenous infection is probably nonexistent, since lymph gland involvement is, as a rule, not observed."

Our own experience, as the case history will show, does not agree with the above, as to extension from the canal. In our case it did not extend from the postauricular region, since this lesion appeared late in the course of the disease. Evidence against the spread from the eustachian tube was the lack of a primary focus in the mouth or nasopharynx.

The fungus seems rarely to attack bone, as is shown in the great disproportion between the infections of the soft tissues of the mouth and the mandible.

The prognosis is bad, as may be seen from the following:

Ginsberg: Died; no operation.

Majocchi: Died; no operation.

Drury: Died; operation.

Zaufal: Died; operation.

Seithoff:⁷ Well; mastoid, surrounding neck and middle ear. Ear well in four weeks; neck in nine weeks.

Reinhard:¹⁰ Died; operation.

Urbantschitsch: Well; no operation.

New: No history given.

Martin: Died; operation.

Reviere and Thevenot: Well, apparently no bony involvement; operation, drainage of the neck, ear cleared.

Urbantschitsch reported four cases treated surgically with one recovery, and one not operated upon but treated with potassium iodid, 2 gm. doses per day for four weeks. Drury's cases and ours were both subjected to operation and both resulted fatally. The case of Urbantschitsch, which recovered without operation, is stated to have had a fistula, probably into the mastoid, but no X-ray findings are given. In short, all patients showing bony involvement of the mastoid, definitely proven, have died in spite

of the operation to clear the condition, which in each case was mastoidectomy, varying in extent with the extension of the disease, and in our case extending to a decompression.

The two cases which recovered were of the middle ear and had no bony involvement of the mastoid, which seems to be the determining factor in the prognosis.

New, from a large experience at The Mayo Clinic, advises iodids in doses of ten drops, three times daily, increasing one or two drops a day until 200 drops three times a day are reached. If iodism occurs, discontinue for a day or two and resume at the same dose. After 200 drops are reached, discontinue for a few days or a week, and then begin again at ten drops. By this method he states that they have cured practically all except the advanced cases, in which, on account of the proximity of the skull or chest, the infection has spread to the meninges or the thorax. He advises radium in breaking down the indurated, granulomatous areas, using 2 mm. lead, 1-inch wood screen, with a dosage of 3000 to 6000 m. c. hours. The wounds are widely drained and swabbed with iodine.

Our patient received iodides but only up to 60 grains a day, so we may have given too small doses or our type of streptothrix may not respond as does the actinomyces subgroup.

Drury used quartz light without effect.

In cases with widespread bony necrosis in the mastoid and resultant secondary infection it would appear that we are limited to iodids and iodine plus surgery, unsatisfactory as the latter evidently is. Certainly radium in large doses would be a formidable procedure in an area with the exposed dura and the labyrinthine capsule immediately adjacent.

Case Report.—Felix M., Italian, aged 22, of Napa County. Presented a discharging fistula over the right post auricular gland and two incised swellings on the posterior and inferior canal wall into what appeared to be furuncles, which allowed but a minute portion of the drum to be seen. This was normal and there was no discharge in the canal. The head was held as in spasm of the sternomastoid.

The past history was not unusual. The patient had been in contact with cattle and had been swimming in tanks frequently during the past three months. There was no history of contact with cattle having "lumpy jaw" or humans with any such infections.

Two months ago the patient developed pain in the right ear caused apparently by multiple furuncles of the canal, which were treated as such

by the physician who saw him. These recurred continuously. In two weeks "boring pain" developed over the right side of the head. Seven days later a swelling developed over the right side of the head from the vertex to below the mastoid tip and the temperature rose to 102. In twenty-four hours a reddish, fluctuant area showed over the postauricular gland which, on incision, discharged a large amount of yellowish pus with relief of symptoms.

On entry, general examination, eye grounds and reflexes were normal. X-ray of the mastoid showed a "granular appearance of the right mastoid, possibly due to operative measures." There was no mastoid tenderness nor could bone be felt at the bottom of the postauricular fistula.

After five days the temperature rose to 102 again and a right mastoidectomy was done. The periosteum was adherent; no fistula was found; the fibers of the sternomastoid were leathery, tough, with a gritty feeling when cut. The bone was sclerotic but felt gritty to the curette. There were four marble sized cavities containing yellowish, gelatinous pus, one communicating with a large perisinus abscess. The sinus and adjacent dura were exposed until normal dura was reached. The dura of the middle fossa was normal. The entire mastoid tip was removed and the wound was left open, lightly packed with gauze.

The report on the curettings was "acute inflammatory process—no bacteria noted."

In a few days a large amount of yellow pus welled up from the tip region which was opened and packed with 1 to 5000 potassium permanganate dressing. Repeated examination of the pus showed a fungus but no sulphur granules. Nevertheless potassium iodide, five drops t. i. d., was begun and increased to twenty drops t. i. d. when iodism supervened and it had to be discontinued after seventeen days.

Twenty-four days after operation photophobia and increased headache were complained of, but no neurologic signs presented themselves. Two days later the patient was irrational at times; temperature 38, pulse and respiration normal. On the twenty-eighth day a transient left sided hemiplegia developed, accompanied by a dilated left pupil, twitching of the left side of the face, normal pulse of 70, and normal respiration. This lasted one hour and left a very slight weakness of the left hand and a fine intermittent nystagmus to the left; the reflexes were hyperactive (left) with a positive Babinski. A craniotomy in the right temporoparietal region was done by Dr. Howard Brown, whose report follows:

"The dura was very tight and under evident pressure. A small opening was made in it and immediately beneath was a yellowish thick tenacious material. The opening in the dura was enlarged and, as the brain was pressed back, this thick pus extruded from all directions over the cortex. It was evident that the involvement was extensive and impossible to reach completely. A rubber dam drain was placed between the dura and the wound was packed open with vaselin gauze. It later drained freely but endlessly.

The patient was very stuporous following operation, and had frequent spells of facial twitching involving the left side. His condition gradually became worse. He made practically no effort to move at all and complained very little. He succumbed on the eighth day after the craniotomy without further new neurologic findings.

The striking point is that the man had such extensive involvement of the central nervous system, with very little in the way of neurologic findings until the onset of the hemiplegia. It is hardly possible that the extensive central involvement occurred between the onset of paralysis in the morning and operation that night.

Involvement of the central nervous system is quite uncommon in the disease; only nine cases out of 670 cases reported by Sanford and Voelker up to 1925 in this country, had central involvement. Sternberg in 1910, reports a case of meningitis following otitis media, and Beck's report of Zaufal's case indicates a pachymeningitis.

A resumé of the postmortem findings is as follows:

Furuncle of the right aural canal. Mastoid operation. Thrombosis of the lateral sinus.

Purulent meningitis; cerebral abscess rupturing into the ventricle.

Small peripheral pulmonary emboli.

The organism is a streptothrix; its subclassification is not completed.

Lungs: The two lungs are similar. Both show along the periphery a few elevated dark red circumscribed areas. Sectioning through this nodule in most instances revealed a dark mass (apparently embolic) which bulged above the cut surface. In one instance the center of such a mass appeared gray and soft. Near the hilus, on the left, thick yellow cheesy material found in a small bronchiole. (This was cultured.) The hilus lymph nodes were small, anthracotic.

The scalp has been shaved on the right side. It is thick and edematous over the right temporal and mastoid regions. An incision is seen in the scalp vertically, about 5 cm. in length, in the right temporal region. Beneath it is an opening through the skull.

A right mastoid incision is seen. The edges are inverted and a thick tenacious yellowish red exudate escapes freely from it.

The calvarium is removed in the usual manner. A heavy yellowish or yellowish green tenacious exudate covers practically the entire right cerebral cortex except for a vertical strip about 2 cm. in diameter in the region of the motor cortex. The exudate

is in the anterior and middle fossæ, about the optic chiasm and over the surface of the pons. It does not extend further posteriorly than this. There is apparent actual invasion of the superficial portions of the cortex. The lateral transverse blood sinuses on the right are thrombosed. A dry gray clot is demonstrated. The thrombosis extends into the right jugular vein.

At two points the calvarium has been penetrated. One at the upper lateral angle of the anterior slope of the petrous bone; the other along the lower margin of the posterior slope of the same bone. The petrous bone is chiseled out. The remaining mastoid air cells contain a gelatinous exudate. The middle ear is moist, the ossicles appear intact, as does the membrana tympani.

Brain: On sectioning the brain one observes that there is a loss of cortical substance about the base and lateral aspects of the temporal lobe. The inferior and to a less extent the posterior horns of the right lateral ventricle show areas of softening and necrosis. The left hemisphere shows no change in structure or position.

Only positive findings are given. Organs which fail to show changes are not described in this study.

Numerous sections from the lung show occasional alveoli filled with serum and fibrin. In some fields the interalveolar septa are congested and thick. Sections through the nodules, noted in the periphery of the lung grossly, show circumscribed areas of recent hemorrhage. Undoubtedly recent emboli. In the one instance in which a small yellow central area was noted grossly, with an H. and E. stain, a central necrotic focus is noted. With Gram's stain one observes a loose mesh of granules in the filaments. The organism is not acid-fast.

Skin from the margin of the mastoid wound: The epithelium is intact. About 1 cm. below the surface is a strata of granulation tissue in which the fibroblasts are embryonal. There are many capillaries; a few lymphocytes and considerable fibrin are found in the tissue. No organisms are found with a Gram's stain.

There is a massive fibrinopurulent exudate on the cortex of the brain, in some instances extending into the brain substance. Most frequently along the meninges, but sometimes in the cerebrum, one finds a zone of delicate granulation tissue adjacent to

the mass of exudate. In the cerebrum more frequently one observes an abscess with no substance. There is nothing characteristic in the architecture of the reaction. In the exudate and meninges one finds fine Gram negative spheres which may be organisms. No filaments are found.

The striking thing to be noted is the disparity between the clinical findings and the operative and postmortem findings.

The final classification as to subgroup has never been completed by the bacteriology department, as it resisted attempts to culture it. The only report is streptothrix. It was repeatedly obtained in smears from the wound, and yet at postmortem no filaments were found in the brain.

384 Post St.

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XCHL.

DECOMPRESSION OF THE FACIAL NERVE FOR
POSTOPERATIVE FACIAL PARALYSIS:
REPORT OF TWO CASES.*

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NEW YORK.

Facial paralysis resulting from a mastoid operation should immediately be followed by a decompression of the facial nerve.

Ney¹ has pointed out that an intact nerve trunk is very resistant to surrounding suppurative processes and that nerves may lie for many months in immediate contact with an active suppuration without functional impairment, while, on the other hand, the facial nerve is extremely susceptible to "compressive" lesions, due to the fact that in the tympanic and mastoid segments it traverses a bony canal which it completely fills and to which its sheath is intimately attached. Nerve lesions, which under ordinary circumstances in the soft tissues would go through the swelling and exudative stages necessary for the traumatic repair with little if any disturbance of function may, in the facial canal, be functionally destructive beyond all relation to the severity of the injury, due to the fact that the inflammatory exudate and swelling accompanying the injury are immediately converted into compressive factors by the solid bone surrounding the nerve.

The immediate removal of the bone surrounding the injured nerve permits the swelling and reparative processes to occur without compression and offers the quickest possible repair and restoration of nerve function. After the bone has been removed it is very important to remember that the sheath of the nerve must be opened at the site of the injury.

In its course through the temporal bone, the facial nerve traverses three separate routes. They are called the labyrinthian, the tympanic and the mastoid segments.

*Presented before the Otological Section of the New York Academy of Medicine, March 13, 1931.

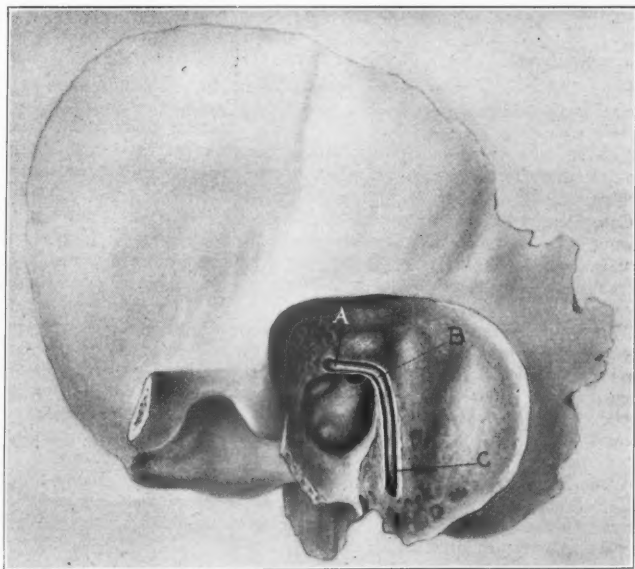
The labyrinthian segment enters the bone through the internal auditory meatus, from the posterior cranial fossa, running from within outward in the horizontal plane between the cochlea and the vestibule. The nerve in this location is not accessible to injury during a mastoid operation. It then makes a right angle turn at the genu or knee commencing the tympanic segment which enters the fallopian canal on the internal wall of the middle ear just above and slightly anterior to the point where the ligament of the tensor tympani muscle is given off for its attachment to the handle of the malleus. This ligament is a reliable guide to the position of the nerve during the radical operation. The tympanic segment runs directly backward and slightly outward through the fallopian canal in the horizontal plane until it passes between the horizontal semicircular canal and the oval window; then it makes another right-angle turn, forming the mastoid segment, which runs directly downward in the vertical plane along the bottom of the posterior canal wall, leaving the temporal bone through the stylomastoid foramen at the mastoid tip. In its horizontal course across the internal wall of the middle ear through the fallopian canal, the nerve is covered by an extremely thin layer of bone and is directly accessible to injury by the curette or undue pressure during the radical operation. Unless a very gross error in surgical judgment is committed, this portion of the nerve cannot be injured during a simple mastoid operation. MacKenzie gives the length of the different segments as follows:

The labyrinthian segment, about 4 mm., the tympanic about 8 mm., and the mastoid segment about 7 mm. He also terms the bend between the mastoid and tympanic segments, the pyramidal segment and gives its length from 2 to 6 mm., and the average length of the facial canal in the adult, 24 mm.

The radical operation constitutes a small percentage of the total number of mastoid operations; the big majority of injuries, therefore, occur during the simple mastoid operation and involve the vertical portion of the nerve in its course between the horizontal semicircular canal and the mastoid tip. Both the mastoid and the tympanic segments are liable to injury during the radical operation with the probabilities favoring the portion covered by the thin bone in the fallopian canal.

In a very large percent of the cases the nerve will be found to be injured but not completely severed. This makes the prognosis more favorable. Suturing of the nerve may be tried where it has been completely severed. The writer has not had an opportunity to operate upon an injury of this type.

Case Report 1. Decompression of the Facial Nerve for Facial Paralysis Following a Radical Mastoid Operation.—Girl, aged ten, first examined twenty-two months after a radical mastoid operation had been performed on the left ear. There was a complete paralysis of the left side of the face, following the operation, with about a forty per cent restoration of function since the operation. The radical cavity was filled with granulations and foul smelling discharge indicating the presence of bone destruction. Labyrinth active, history otherwise negative. Owing to the fact that there was a forty percent recovery in function and that nearly two years had elapsed since the operation, I was reluctant to do a decompression of the facial nerve for fear of losing some of the function already restored. With direct evidence of bone destruction present, I de-



LEFT MASTOID.

Case 1. Decompression of the facial nerve from A to C.
Case 2. Decompression of the facial nerve from B to C.

cided to perform a second radical mastoid operation and a decompression of the facial nerve, if it seemed advisable.

Operation.—The radical cavity was reopened, an extensive area of the diseased bone removed and the radical operation completed, the thin bone covering the nerve in its horizontal course through the fallopian canal had been crushed in and a mass of granulation tissue was found adhering to the nerve at this point. The bone covering the nerve in the tympanic region was removed and then the bone in the facial ridge over the mastoid or vertical portion of the nerve was gradually shaved away with a small sharp Richard's curette and a small sharp chisel. A steel applicator with the end sharpened and flattened was used to free the nerve from its bony canal. The decompression in the mastoid segment was carried downward to a point about 2 mm. above the stylo-mastoid foramen. Granulations attached to the nerve at the site of the injury were excised with a small cataract knife. Particular care was taken to avoid injuring the horizontal semicircular canal or removing the stapes. The radical cavity was then cleansed and a small piece of plain gauze, wet with normal saline solution, placed in the cavity. The usual postoperative radical treatment was carried out, using normal saline solution for cleansing purposes.

The meatal flap gradually contracted, preventing proper access to the radical cavity. An anesthetic was given about four months later, the meatal flap enlarged and some granulations removed from the cavity. There was a gradual lessening of the discharge and the ear became completely dry after several months.

Four and a half years have elapsed since the decompression of the facial nerve. There was no impairment of the regained function immediately following the operation, there has been about thirty percent additional recovery of function, making the recovery seventy percent despite the fact that the decompression was performed nearly two years after the original injury.

Case Report 2. Decompression of the Facial Nerve for Paralysis Following a Simple Mastoid Operation.—Girl, six and one-half years old, first examined one day after a complete simple mastoid operation. There was a history of three weeks acute otitis and mastoiditis preceding the operation, no previous trouble with ear or face, history otherwise negative.

The simple mastoid wound was immediately opened under a general anesthetic, the nerve had been exposed in the mastoid segment just below the horizontal semicircular canal almost to the stylomastoid foramen. The covering had been scraped with a curette the whole length of the exposure. The whole nerve was red, swollen and edematous and about twice its normal size. The membranous canal was separated to the tympanic ring, the facial ridge lowered, the bone shaved down to the level of the nerve with a sharp Richard's curette. Some of the bone at the edges of the canal was removed. The nerve was then separated from its bed in the canal about 1 mm. above and below the points of injury.

The tympanic segment had not been injured, the drum and ossicles were not removed.

A flap was cut enlarging the membranous meatus, converting the simple mastoid operation into a modified radical operation with the drum and ossicles intact.

The facial paralysis had completely disappeared four months after the operation.

It is ten months now since the nerve was decompressed, there is slight mucoid discharge from the eustachian tube, the face is normal.

COMMENT.

Although the decompression of the nerve for the paralysis following the radical operation was not performed until approximately two years after the injury, there was no loss in the 40 per cent function regained during the two year interim, and there was an additional 30 per cent recovery of nerve function.

This makes a 70 per cent recovery when there was practically a complete decompression of the nerve in both the tympanic and mastoid segments.

The paralysis following the simple mastoid operation was completely recovered four months after decompressing the mastoid segment of the nerve.

These cases prove conclusively that both the mastoid and tympanic segments of the facial nerve may be decompressed without interfering with the nerve function.

All cases of traumatic facial paralysis resulting from a mastoid operation should be followed by a decompression of the facial nerve.

123 EAST 53RD ST.

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XCIV.

THE DEVELOPMENT OF HEAD LIGHTS AND THE INTRODUCTION OF A NEW LIGHT.

PALMER GOOD, M. D.,

CHICAGO.

The improvements in methods for illuminating the deep cavities of the human body have marked some of the greatest advances in otolaryngology. Unfortunately historians have not kept as accurate records of the development of new illuminating devices as they have of the accomplishments with them. Therefore, many of the exact dates cannot be told, but the sequence of changes is rather certain and of considerable interest.

Except for the head mirror, the first attempt to produce an illuminating apparatus for deep cavities was that of Bozzini of Frankfurt, in 1805. This apparatus consisted of a candle, candle-holder, a housing which supported a tube, about 10 inches long and one-fourth inch in diameter, and a partition which shielded the visual aperture from the candle flame. This was used for urethral examinations. Segales of Paris later improved this method by using two candles and two concave mirrors to reflect the light. Vaginal and rectal speculums were added. In 1853, Desormeux of Paris introduced a new method in which the source of light was an oil lamp, the rays of which were converged by a convex lens and were reflected 90 degrees by a mirror with a central aperture. It was with this light that the first esophagoscopy was performed, and Desmoreux earned the title, "Father of Endoscopy."

Dr. Julius Bruck of Breslau, in 1867, and Dr. Von Mickulicz, in 1881, with the help of Mr. Leiter of Vienna, constructed an esophagoscope which was illuminated by an electrically heated platinum wire at the distal end of the tube. So much heat was generated that it was necessary to have an outer water chamber through which a constant stream of water was forced. In 1886, the Edison incandescent bulb replaced the platinum wire, but it

also generated considerable heat, because it was of the carbon filament type. This was the beginning of the distal illuminated tubes which have been developed largely by Dr. M. Einhorn of New York in 1902, Dr. F. Ingals of Chicago, in 1904, and Chevalier Jackson, in 1905.

In 1893, thirteen years after the invention of the incandescent bulb, an electric head light appeared in the World's Fair catalogue of Truax-Greene and Company of Chicago. This consisted of an electric bulb and condenser lens mounted on a head band. This simple type of head light has undergone many changes in size and support but still remains fundamentally the same.

About the year 1890, Dr. Kirstein designed a head light consisting of an Edison electric bulb, condensing lens and mirror, held at an angle to bend the rays of light 90 degrees. It was similar to the method used by Desormeux, except an electric bulb replaced the oil lamp and the size was greatly reduced so that it could be worn on the head. With relatively few changes, it is still one of the most popular lights. It was with this light that Killian, in 1897, did the first bronchoscopy and removal of a foreign body, designating him "Father of Bronchoscopy."

Toward the end of the last century, Mr. Leiter constructed, at the request of Dr. Von Hacker, the panelectroscope, which was the first illuminating apparatus to be built into the handle of an endoscope. This method has been improved upon by Kirstein, Kasper, Gottstein, Bruening, Kahler, Von Schroetter, Hasslinger and others.

During the first part of this century the Klar light appeared. It consists of a large concave mirror of relatively short focal length and electric bulb supported at the shorter focus with rays converging at the conjugate focus. There were two apertures instead of one, as in other types of apparatus. This light became very popular and remains so today, in spite of the fact that it retains many of the defects of the head mirror, especially lack of co-axial illumination, no increase in intensity of illumination, and the presence of a sharp focal point.

Quisez introduced a new principle about this time, which consisted of a fiber disc with a central aperture, and three electric

bulbs with three condensing lenses mounted around the hole to cast their light upon a single field of light. This type of head light never became very popular.

Recently, Dr. Wessely of Vienna constructed a head light upon a new principle, which will be described later in the classification of present day head lights.

Before describing the various kinds of head lights, the writer deems it advisable to list the qualities of a head light which would make it ideal for the otolaryngologist.

1. It should be useful in every kind of examination or operation, including tonsillectomy, nasal operations, radical mastoids and bronchoscopy.

2. It should produce a brilliant field of illumination of about 1000 lumens, or foot candles. It must be brilliant, because many of the cavities are illuminated obliquely and a relatively small amount of light is reflected.

3. The field of light should be uniform, the vertical and horizontal diameters about equal, and adjustable from $\frac{3}{4}$ inch to 3 inches in diameter.

4. The rays should be parallel so that no sharp focal point exists.

5. Co-axial illumination should be possible.

6. The source of light should be adjustable so that it can be worn between the eyes, over one eye or at the side of the head.

7. The beam of light should be adjustable so that it can be deflected sharply down for general tonsillectomy or examination of patients in bed.

8. The aperture of the mirror should not be smaller than the average size of the pupil of the eye, so that the amount of reflected light returning to the eye is not reduced. This is about $\frac{1}{4}$ inch.

9. There should be no glare from the edge of the aperture.

10. Standard bulbs should be used, as they are readily obtainable and low in cost.

11. There should be no possibility of shock.

12. Overheating must be avoided.

13. Durability must be incorporated so that the light will have a long life, be reliable and enable the owner to carry it with him in his bag.

14. A single adjustment should suffice for an entire operation.

The head mirror does not have sufficient brilliancy nor size of field, even if a condensing lens is used in connection with the source of light. It does not permit co-axial illumination, because a large majority of the rays comes from points too far from the central aperture and require constant readjustment for each movement of the light, operator or patient. Because of these defects in the head mirror there have been many attempts to produce a satisfactory head light. While some of them have succeeded in fulfilling one requirement or another, none of them have been entirely satisfactory. Today there are a great many head lights for sale, and many others have been discarded into the ever-increasing barrels of obsolete instruments. To help the otolaryngologist select the light that is suited to his requirements, I will classify about twenty of the most popular types and state their advantages and disadvantages.

The first group is marketed under the names of Murphy, Reeder, Beck, Marion, Davis, Stucky, Smith and others. They are simply an electric bulb with a shade and head band. With the exception of the Smith light, they all use a 110-volt bulb, which is very fragile and the shades become very hot. The Beck light attempts to reduce the heat by increasing the size of the shade. The Marion light, of French origin, covers the shade with cork to prevent the burning of the operator. The Smith light uses an automobile light and glass reflecting mirror, thus producing a very bright light without great heat. The greatest difficulty with this type of light is that it is too large and the rays of light come from a point too far from the visual axis for good illumination of the mouth for tonsillectomy. Thus the otolaryngologist finds very little help in this type of light.

The second group is similar to the first, except that a condensing lens has been added to give greater penetration and incidentally reduce the size of the source of light. All of this group use a low voltage bulb and condenser lens of varying size and strength. They are much more useful to the otolaryngologist, as

most of them may be worn between the eyes, but even at best, such as the Hasslinger type, good oral, nasal and endoscopic examinations cannot be done. They are sold under the following names: Envalite, Kayess, Cameron, Jamsen, Speck-Lite, Wolff, Hasslinger and others. None of these lights are bright enough.

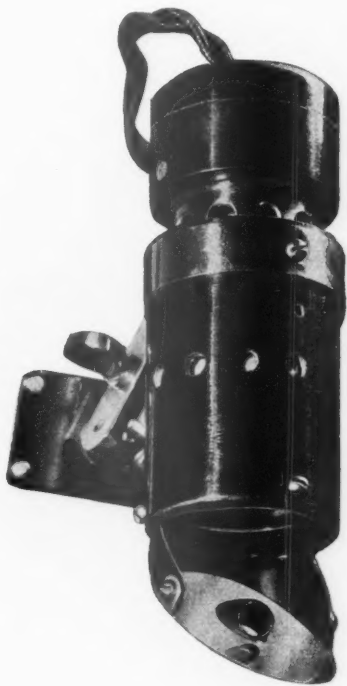
The third group utilizes concave mirrors to converge the rays of light. There are two, the Klar and the Blakesley. The Klar light has one theoretical advantage, and that is that both eyes are useful for examination, but as deep cavities can be viewed by only one eye at a time, the advantage is of little value. It does not fulfill many of the standards set down above and lacks brilliancy and uniformity of the field of light, co-axial illumination, adjustability for the deflection of the rays, parallel rays and durability. The Blakesley has a smaller mirror with a single eccentric aperture. It has better penetration of the deep cavities but does not have a uniform field, brilliancy, freedom from glare from the edge of the aperture, nor durability.

The Relascope, designed by Dr. Wessely of Vienna, uses an entirely new principle. By means of prisms the usual pupillary width of the eyes is reduced so that both eyes receive their visual rays from a point in the midline of the body. The illuminating system is also in the midline and casts a light straight ahead. The field of light is adjustable in size, and the rays may be deflected or elevated somewhat. With this light it is possible to look through an endoscopic tube with both eyes, but it must be remembered that the picture cast on each retina is identical and that a stereoscopic view is not obtained. It is my opinion that the blinding of one eye by this instrument for things about the tube or speculum is a distinct disadvantage. A unique feature of this light is that two observers may watch the field of operation at one time. The view is, however, reversed as in a mirror.

The last group is represented by the Kirstein and the author's present instrument. The Kirstein has been previously described and fits into the requirements better than any other light. However, it has the following drawbacks: It is very dim compared to the standard, the field is not uniform, the rays cannot be deflected, it is not easily worn between the eyes, the aperture is not

large enough, it has a glare from the aperture, and the shocks are not eliminated.

Because of the fact that no head light was available that fulfilled even a majority of the requirements stated, the writer began the construction of a head light about ten years ago. Since that time five models have been made, but the latest one is now pre-



sented to the profession for the first time, confident that it fulfills all the requirements previously stated.

The author's light is constructed on the principle of Kirstein and has added to it the improvements of Bruening and the writer. The oval mirror and partially shielded aperture were original with Bruening. The oval mirror is of importance because it is

just the shape necessary to reflect the rays of light. The round mirror either fails to catch the rays at its lower or upper border or is much wider than is necessary. This is of importance because the light must be worn between the eyes for some work, and if a round mirror were narrow enough to fit between the eyes it would fail to reflect many of the available rays. The shield of Bruening, made to protect the edge of the aperture, was only a tongue of metal and was only partially successful. The author's light uses a tubular shield so that all possibility of glare is eliminated. It is thought that this light is the only illuminating apparatus with a glare-free aperture. A 15-candle power automobile stop light was selected for the source of light, because it has a long life, great brilliancy, and the socket connections do not loosen as does the screw type of base. It is obtainable in almost every garage all over the world and costs very little. Its greatest advantage, however, is that its filament is essentially a straight line, and every part of it can be brought in focus because it is all equal distance from the condensing lenses. Two plano convex optically ground lenses of 20 diopters each and $1\frac{1}{4}$ inches in diameter are used to condense the rays of light. They permit the greatest efficiency and clear image of the filament if focused.

The flat reflecting mirror of Kirstein was not satisfactory because a large central aperture made a dark spot in the center of the field of light, and because, with the straight filament, the field of light was in the form of a streak. It was discovered by the writer that a slightly concave mirror would eliminate the dark spot and also introduce astigmatism into the system so that the streak could be broadened until the field became about square. It is generally known that a convex lens held obliquely has an astigmatic error, and the concave mirror has the same characteristics as the convex lens. By properly combining the strengths of the condensing lenses and the concave mirror it is possible to make a uniform field of light that is almost square. The mirror is constructed of tarnish proof metal to prevent breakage.

Burning of the operator or assistant is prevented by enclosing the hot parts in bakelite, which is a nonconductor of heat. Shocks are absolutely eliminated by keeping the electrical circuit separate from the frame of the light. The 110-volt current is reduced in

two ways. A transformer is furnished for alternating current, because it is most efficient, does not heat and does not deteriorate. For direct current a rheostat is furnished. The separable plug is of bakelite and will not break if dropped or stepped on.

Because this light fulfills all the requirements stated and because it is superior to the best in each classification of lights, it may be called the universal light. It is superior to the groups using only an electric bulb or an electric bulb in connection with a condensing lens, because it is much brighter, does not overheat, and because it can be worn close to the head, between the eyes, it makes the wearer unconscious of the source of light and allows a shadow-free stereoscopic view of the mouth, larynx or plane surfaces. It is superior to the reflecting type of head light because there is no sharp focal point and it is much brighter.

In bronchoscopy and esophagoscopy it is used with the endoscopic tubes of Killian, Bruening or Hasslinger. The advantages over other methods are many, but particularly as follows: More light, no electrical connections to the tubes, no interference with instrumentation, protection to the operator's eye or glasses and illumination that penetrates far beyond the end of the tube.

In the writer's experience his light has replaced the head mirror entirely.

715 LAKE ST.

The Scientific Papers of the American Bronchoscopic Society

XCV.

STRICTURE OF THE ESOPHAGUS CAUSED BY PEMPHIGUS.*

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NEW YORK.

This rare and uncommon disease, undoubtedly of bacterial origin, produces lesions in the mucosa that are of a bullous character. The characteristic small blister, the size of a pea, which later ruptures, best describes it. They may vary in size and shape. If there are several lesions that coalesce, there may result an erosion with subsequent contraction, and, occurring in the esophagus, it is easily seen how a stricture-producing obstruction may result.

A case history of A. E. M., 68 years old, is as follows:

His chief complaint was difficulty in swallowing for the past ten months. He had pemphigus of the mouth, pharynx, conjunctiva and left side of his face for a period of thirteen years. He spat up some blood about three years ago. Roentgenogram showed a stricture at the sixth cervical vertebra that reduces the caliber very much, so that it permitted a stream of barium about 3 mm. to pass through. There was marked inhibition in the patient's ability to swallow with a sufficient speed to outline the esophagus. Constant coughing and choking induced marked inanition.

Esophagoscopy done at the New York Post Graduate Hospital, under no anesthesia, showed a stricture at the cricopharyngeus

*Read before the meeting of the American Bronchoscopic Society, St. Louis, June, 1931.

through which a 14 French bougie was passed with some difficulty. Later a 24 French was introduced and left in situ for ten minutes. The appearance of the mucous membrane was that of cobwebs scattered over it. Generally, the appearance of the stricture was that of a soft traumatic or lye stricture, excepting it did not give one the impression that it was deep. This divulsion of the stricture was done December 23, 1930, and the patient was able to swallow without difficulty the next day and has continued to do so up to the present time.



A indicates stricture of the cricopharyngeus. Larynx and trachea do not show in the photograph because of the lack of detail in the roentgenogram.



XCVI.

COMPLETE ATRESIA OF THE ESOPHAGUS.*

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NEW YORK.

This is an unusual sequence following traumatic or chemical injury to the esophagus. As a rule, there remains a very small passageway, even in the severer injuries.

N. G., age 25 years, was admitted to the New York Post Graduate Hospital, September 5, 1929, with a history that he had not been able to swallow fluids without regurgitation since August 31, 1929. He had lost ten pounds in weight within the past five days and felt very weak.

His previous history dates back to six months ago, when he had an appendectomy, and this was complicated by a subphrenic abscess and some other abdominal conditions. However, he experienced difficulty in swallowing immediately on recovery from the anesthetic. No comprehensive history could be obtained from those who operated upon him that could explain his esophageal obstruction. Within a few weeks the esophageal condition was giving him so much distress that he was esophagoscoped, and the findings were ulceration of the lower portion of the esophagus in the region of the cardia. These ulcerations were treated by cauterization and he received nine dilatations from the physician who originally esophagoscoped him.

The patient insisted that he was progressively losing weight and swallowing with increasing difficulty over a period of three months. He had lost thirty pounds following the original operation and since not being able to swallow at all (August 31, 1929) had lost an additional ten pounds.

A summary of a physical examination done on him showed an emaciated young man. Heart and lungs normal. Large puck-

*Read before the meeting of the American Bronchoscopic Society, St. Louis, June, 1931.

ered scar in right abdominal region extending to free border of rib. Acetone odor to breath. Trace of albumen in urine and acetone. Temperature, 100. Pulse, 88.

Esophagoscopy was done without anesthesia and a complete stenosis of the lumen was encountered at 40 cm. from the upper teeth. There was no ulceration noted. The walls of the esophagus appeared to be glued together. At the very depth of the atresia the walls were slightly congested and considerable saliva was aspirated. Slight dilatation of esophagus. Bouginage attempted but desisted because of nonability to visualize end of bougie. Gastrostomy advised, in conjunction with esophageal placement of a thread within the stomach, in order to dilate the stricture by the retrograde method. This was done the following morning. In the interim the patient retained 1500 cc. of glucose, saline bicarbonate of soda solution and the acetone had disappeared from his urine. He appeared to be much improved. A general anesthesia was used.

After the stomach was opened, the surgeon, Dr. Rupert F. Carter, placed his index finger in the cardiac end of the stomach and up in the esophagus until he encountered the atresia. Esophagoscopy was done at this time, and a Plummer bougie without an olive on it was introduced through the esophagoscope. Dr. Carter could feel the beak of the esophagoscope through the stenosed area and eventually the end of the Plummer bougie—this was pushed down on his finger as a guide and eventually through the gastrostomy. A No. 10 silk thread was attached to the end of the bougie and drawn into the esophagus and mouth; later withdrawn through the nose. It was of interest to note that there was no saliva in the stomach—but there was considerable in the esophagus above the stricture. There was a moderate dilatation of the esophagus. The total time of this operation, including the induction of the anesthesia, was thirty-five minutes.

He reacted well and within two days could swallow water by mouth. He developed a parotiditis and his temperature was 102—at times. The gastrostomy wound was healing nicely and he retained and assimilated over eighty ounces of "high caloric"

fluid every twenty-four hours. He also received ten to sixteen ounces of water through the gastrostomy.

By September 14, 1929, he was able to get out of bed. On September 16, 1929, the first retrograde dilatation was done, using a No. 16 Tucker at first and eventually getting up to a No. 26, which was retained in the esophagus for twenty minutes. On the next day he swallowed food by mouth and subsequently all feedings were by mouth. The gastrostomy tube, however, was retained. By September 19th, he was taking and retaining 135 ounces of fluids per twenty-four hours and he gained twenty pounds. He was allowed to leave the hospital by September 20th, weight being 125 pounds.

Retrograde dilatations were done about every ten days and increasing the intervals so that by August 5, 1930, a No. 40 Tucker retrograde was easily withdrawn through the stricture. The gastrostomy tube was removed August 5, 1930, and the wound completely healed by September 2, 1930.

On September 26, 1930, esophagoscopy showed a diaphragm of tissue in the left upper quadrant of the esophagus in the region of the atresia, noted September 5, 1929.

In all, twenty-one dilatations were done. The esophagoscopies were done with a 7 mm. full lumen Jackson. The strictured area was easily passed and the stomach mucosa identified.

The subsequent history of the patient is that he can eat everything. At times, if he hurries in swallowing, he may get hic-cough. He can eat steaks, bread, grapefruit, mashed potatoes and apples. His weight (April 24, 1931) was 137 pounds.

A roentgenogram of the esophagus shows dilatation at the seventh dorsal. There is a narrowed portion about 1 cm. in diameter extending to the tenth dorsal. Below this there is a bulbous dilatation before entering the stomach. Contour of wall, smooth.

COMMENT.

1. The combination of gastrostomy and esophageal penetration from above through the esophagoscope and the manual guidance of the penetrating instrument from below.

2. Retrograde dilatation.
 3. The continuance of the gastrostomy wound for eleven months but using it for feeding less than one month.
 4. With proper attention to the gastrostomy wound, no discomfort is experienced.
 5. Number of dilatations, 21.
Length of time, over $1\frac{1}{2}$ years.
 6. Result, functionally cured.
 7. Occasional inspection indicated.
- 108 EAST 38TH ST.

XCVII.

A REVIEW OF ONE HUNDRED CASES OF ABSCESS OF THE LUNG.*

JOHN MILLER, M. D.,

NEW YORK.

This series of one hundred cases of lung abscess was seen at Bellevue Hospital between 1921 and 1931. Seven cases were not bronchoscoped. The great majority were from the tuberculosis service of Dr. James Alexander Miller, who has been responsible for the close co-operation existing between internist, surgeon and bronchoscopist at Bellevue Hospital. There is a relative dearth of children in the series, which can be explained by the fact that relatively few lung abscesses appear to develop in children at Bellevue Hospital.

In some of the cases reported, the differential diagnosis between lung abscess and bronchiectasis was difficult, but in preparing cases for report care was taken to exclude those in which there was any doubt as to existence of an abscess. The use of iodized oil for pneumonography has materially reduced the difficulty of differential diagnosis.

At Bellevue there are countless difficulties in securing follow-up records of a patient after he has left the hospital, so I feel that necessarily our statistical study is not complete because of lack of this data. Letters sent to the addresses given by patients when admitted to the hospital were returned in over 75 per cent of instances with the notation that the addressee had moved and left no address. Another 10 per cent, which apparently were delivered, failed to bring a response. Therefore, we are unable to say what the patient, who was discharged from the hospital as improved, is doing today. Some of the convalescent cases have been placed in convalescent hospitals from which a few were re-

*Read before the meeting of the American Bronchoscopic Society, St. Louis, June, 1931.

From the Oto-Rhino-Laryngological Service and the Tuberculosis Service at Bellevue Hospital.

admitted with relapses. A few have returned voluntarily to let us see how they have gotten along, and there have been an encouraging number of apparently permanent arrests among these cases.

The study of these cases, etiologically, differs in some respects from similar studies at other institutions, but in general checks very closely with them.

AGE AND SEX.

There were eighty males whose average age was forty-one and three-tenths years, the oldest being sixty-seven, the youngest seven. The greatest number of cases were in the fifth decade, with an equal number in the combined fourth and sixth decades. There were twenty females whose average age was twenty-eight years, the oldest being forty-five and the youngest seven. The greatest number of cases were in the third and fourth decades, about equally divided. Thus, there were four times as many males as females and the age at which involvement took place was nearly thirteen years older.

PNEUMONIA AS A CAUSE OF LUNG ABSCESS.

There were seven cases of pulmonary abscess definitely traceable to a preceding pneumonia. Two of these were due to empyema and bronchial fistula followed by closure of the external wound. Fifteen gave a history of acute colds, bronchitis, grippe or influenza just preceding symptoms of lung abscess. It seems possible that the symptoms usually attributed to these conditions might well be prodromal symptoms, associated from the onset with lung abscess formation. Lord¹ does not think any lung abscess forms as a result of an accident of resolution in pneumonia but that it is an independent affection due to aspiration of putrefactive organisms. In his series of 227 cases he states that possibly twenty-eight cases (12.3 per cent) followed bronchopneumonia, not lobar pneumonia. Glowacki,² in 1923, reviewed twenty-eight cases etiologically. Of these, eight followed pneumonia; six of them died. He mentions that there is no record of lung abscess following postoperative pneumonia. Lambert and Miller,³ however, in 1924, in a series of sixty cases, found sixteen lung abscesses following pneumonia and three following postoperative pneumonia.

TABLE I.

ASPIRATION OF INFECTIVE MATERIAL, AS A CAUSE OF LUNG ABSCESS.

Definite foreign bodies.....	3
Aspiration of infective material.....	23
Alcoholic-unconscious	13
Vomiting	3
Epilepsy	3
Fainting spell.....	1
Nasal hemorrhage in sleep.....	2
Nasal hemorrhage following assault.....	1

The most important mechanical factor in the production of lung abscess was the aspiration of foreign material into the tracheobronchial tree. There were only three cases in which a definite foreign body history was given or in which a definite foreign body was present in the tracheobronchial tree, but there were twenty-three cases in which a definite possibility of aspiration of foreign material existed. In the three definite foreign body cases, two of the foreign bodies were vegetal, while the third one was a tooth, knocked into the tracheobronchial tree during a drunken brawl and coughed up several days later. In the twenty-three cases in which the possibility of such aspiration existed there was a period of unconsciousness during which infective material from disease of the upper respiratory tract, the teeth, or vomitus from the gastro-intestinal tract might very well have been aspirated. A glance at the accompanying table (Table I) gives an idea of the frequency with which accidental aspiration is possible. One of these cases, an intelligent young man, volunteered the information that he had vomited while under the influence of alcohol and was told by his friends that he had nearly choked to death. His symptoms began immediately after this occurrence and therefore it seemed logical to consider the condition due to aspiration while unconscious from acute alcoholism. There were thirteen cases in which the beginning of symptoms followed closely enough after alcoholic coma to justify the assumption there was some connection between the two.

There were three cases in which symptoms appeared shortly after an epileptic convulsion. Here again, there was a period of unconsciousness during which it was possible to aspirate foreign material into the tracheobronchial tree. It was thought that if

epilepsy were a usual predisposing factor in the acquirement of lung abscess, there should be an abnormally high percentage of lung abscesses among the inmates of institutions for the care of epileptics. Inquiry at one of the state institutions, however, disclosed that lung abscess was almost unknown there. The author feels that this is a field in which an extremely interesting investigation could be made.

Of the remaining cases included under this heading, there were three in which vomiting occurred as a result of overindulgence in alcohol. These were classified as acute alcoholism, but were not included with the other cases because there was no definite unconscious period followed by lung abscess symptoms; rather, there was retching and an inability to retain food, accompanied by cough as from laryngeal irritation caused by aspiration of foreign material.

Two cases definitely noted that symptoms appeared shortly after nasal hemorrhage which occurred during sleep.

One case, which was never bronchoscoped, because he was extremely ill, had been attacked, choked and left unconscious and bleeding from the nose and mouth. He developed typical symptoms and signs of lung abscess a few days after admission and the final clinical diagnosis was lung abscess of the left lower lobe. At autopsy no lung abscess was found.

Another case of lung abscess closely followed the inhalation of an undetermined irritative substance while at work. Spirochaetes were found in the sputum. The patient was placed on routine medical treatment, given neosalvarsan intravenously, and was bronchoscoped once. In six months' time he was discharged from the hospital as improved.

TABLE II.

CASES OF LUNG ABSCESS FOLLOWING OPERATIONS: EIGHTEEN CASES.

General tonsillectomy.....	11
Local tonsillectomy.....	1
Fracture of mandible with osteomyelitis.....	1
Fracture of patella.....	1
Tooth extraction (local).....	1
Ludwig's angina.....	1
Ventral hernia.....	1
Gangrene of hand.....	1

Eighteen cases followed operations, twelve of which were tonsillectomies. Three additional cases were operated upon for some oral surgical condition. It is worthy of note that the three cases in which local anesthesia was used were cases in which operative work was done about the mouth. The only case of lung abscess which the author knew to have developed in a patient on whom he had done tonsillectomy was a young adult, who took anesthesia poorly, vomited after one tonsil had been removed and bled profusely because the mobility of his throat made it difficult to tie off bleeding vessels. Also, during this procedure the suction apparatus did not function efficiently and more blood than usual found its way into the trachea, probably carrying some foreign material with it.

I feel that otolaryngologists can reduce the number of post-tonsillectomic lung abscesses materially by the exercise of caution in tonsil operations. Pre-operative oral hygiene, the extraction of loose teeth, and not operating until throat and chest are absolutely clear of signs, are essential; at operation, it is necessary that anesthesia be carefully administered, keeping the head lower than the body and getting the tonsils out with the least possible trauma, using an efficient suction apparatus intelligently and not allowing the patient to leave the operating table until all bleeding is stopped.

The ease with which iodized oil finds its way into the tracheo-bronchial tree when the palate and posterior pharyngeal wall are anesthetized suggests the manner in which infective material may enter from the mouth with local anesthesia for operations in the oral cavity or pharynx.

Enumerating the causes of pneumonitis in a recent paper, Alexander and Buckingham⁷ lay particular stress on aspiration of infected material and foreign bodies, and on bronchial obstructions due to mucus plugs and foreign bodies.

Perhaps the reason for the comparatively equal distribution of abscess between upper and lower lobes may be due to the fact that, during the time a patient is acquiring an abscess or conditions leading up to it, he is recumbent and therefore the force of gravity does not favor the lower lobes.

TABLE III.

LOCATION OF ABSCESS.

- 39 per cent of abscesses were located in the upper lobes.
25 per cent in the right upper lobe—14 per cent in the left upper lobe.
46 per cent were located in the lower lobes, 31 per cent on the right side, 15 per cent on the left.
10 per cent were in the right middle lobe.
4 per cent of abscesses were in more than one lobe; one in right upper lobe and right middle lobe; two in both lobes of left lung and one in right upper lobe and right lower lobe. In one case the position of the abscess was not determined.

The importance of bronchoscopic examination in determining the location of a pulmonary abscess has been recognized, especially in cases in which the roentgenologic and physical findings were inconclusive. In one striking instance the roentgen and physical findings pointed to an involvement of the right upper lobe, but several bronchoscopic examinations failed to reveal any pus from the right upper lobe bronchus, while there was considerable pus coming from the right lower lobe bronchus. At autopsy the abscess was found in the right lower lobe with pneumonia of the other lobes.

In Table IV may be seen the frequency with which the usual findings in lung abscess were noted. Those cases in which any marked degree of deformity was seen were cases of long standing. The usual signs were those of infection and, in a few cases in which granulation tissue was present, a small specimen was taken for biopsy. The actual abscess cavity was not seen in any case. No bacteriologic examinations were made on specimens of pus obtained at bronchoscopy. In a number of cases, however, the presence of spirochaetes and fusiform bacilli in the sputum was noted.

One case, a male, fifty-eight years of age, was seen July 15, 1930. At this time the clinical and roentgen ray diagnosis was abscess of the lower lobe of the right lung. When bronchoscoped, a bit of tissue, the size of a pea, was seen projecting from the posterolateral wall of the right bronchus, 30 centimeters from the incisor teeth. This tissue bled freely and, when examined, proved to be granulation tissue. He was bronchoscoped again in March, 1931, and the findings were the same. This patient has recently

died, and the postmortem examination showed the presence of carcinoma just below the area of granulation, together with an abscess of the right lower lobe. This is the only case in the series in which an abscess was found obscuring the presence of new growth. It teaches the value of more than one tissue examination where tissue is available in lung abscess of obscure etiology, especially in a patient who has reached the age at which cancer is likely to develop.

TABLE IV.

BRONCHOSCOPIC FINDINGS.

Obstruction of bronchi.....	23
Right	14
Left	9
Congestion of tracheo-bronchial tree.....	43
Congestion of bronchial mucosa.....	41
Displacement of trachea.....	5
Deformity of carina.....	7
Pus from bronchi.....	82
Right main bronchus.....	11
Right upper lobe bronchus.....	17
Right middle lobe bronchus.....	9
Right lower lobe bronchus.....	21
Left upper lobe bronchus.....	5
Left lower lobe bronchus.....	9
Left main bronchus.....	4
Multiple	4
Not stated.....	2

The most reliable single bronchoscopic sign of pulmonary sup-
puration was the visualization of pus coming from the mouth of
a bronchus. Usually the pus from lung abscess was not as great
in amount as that from bronchiectatic cavitation. There was
swelling and congestion of mucous membrane often definitely
localized to the bronchus of a single lobe. Pus from an abscess
frequently was sufficient to bathe the mouth of a bronchus while
the patient was coughing, but was more often seen directly after
the paroxysm ceased. In eighty-one cases of this series, pus was
definitely traced to a single bronchus. Congestion of the entire
tracheobronchial tree or a part thereof, or the presence of granu-
lation or fibrous tissue, was found in eighty-four cases. By far
the greater number were cases in which there was congestion of
the tracheobronchial tree; twenty-three showed, in addition, bron-

chial obstruction. Displacement of the trachea and deformity of the carina were noted in twelve cases, all chronic, in which ample time had elapsed for the formation of the fibrous tissue in the parenchyma of the lung, glandular enlargements about the hilum, and enlargement of peribronchial nodes.

TABLE V
NUMBER OF BRONCHOSCOPIC EXAMINATIONS MADE.

53 cases	bronchoscoped once
23 cases	bronchoscoped twice
7 cases	bronchoscoped three times
4 cases	bronchoscoped four times
6 cases	bronchoscoped five times
1 case	bronchoscoped six times
1 case	bronchoscoped ten times
1 case	bronchoscoped twelve times
2 cases	bronchoscoped fifteen times

That the bronchoscopic examinations were done largely for diagnosis is shown by the fact that a little over one-half of the cases in this series were bronchoscoped but once. A small number of cases had many bronchoscopic examinations—usually those showing an early improvement after bronchoscopy, followed by a setback, as shown by physical signs, roentgen ray studies or an increase of purulent exudate.

Onset of the Disease.—By far the greater number of cases gave a history of sudden onset of symptoms, usually with chill or chilliness, rise in temperature, cough which was originally non-productive, sooner or later becoming productive of foul sputum. The average time elapsed between onset of symptoms and admission to hospital was five months, varying from a few days to two years.

TABLE VI.
SYMPTOMS.

Cough—all cases	
Expectoration—all cases	
Pain	42
Loss of weight	44
Hemoptysis	26
Weakness	16
Fever	4
Dyspnea	2
Anemia	1

The chief symptoms were cough and expectoration. These were found in practically all cases studied at some time during the course of the disease. The first or earliest cough was usually nonproductive but later became productive of foul sputum. Occasionally hemoptysis was an early symptom, the result of a particularly severe paroxysm of coughing, and varied in amount from streaking to hemorrhage of alarming proportions.

On several occasions during treatment postural drainage and bronchoscopy, or both, had to be discontinued because of hemoptysis. A very large proportion of cases had fever, but a very small number complained of it as a symptom. In addition to cough, expectoration and hemoptysis, pain and loss of weight and strength were the most complained of. Dyspnea was apparently not alarming, for it was rarely mentioned.

Prognosis.—The outlook for any patient with lung abscess obviously is influenced by his general physical condition, the severity of the infection, the time elapsed between the formation of an abscess and the institution of proper treatment, and the presence or absence of complications. The site of the abscess apparently has some bearing on the prognosis.

F. G. Lord¹ estimates the mortality of medically treated lung abscess at 75 per cent. Recovery without operative intervention may be expected in 10 per cent of cases. James Alexander Miller⁴ states that 50 per cent of cases of lung abscess diagnosed and placed under treatment early will clear up with prolonged rest, posture and bronchoscopy. Glowacki² is of the opinion that the prognosis in lung abscess under palliative treatment is favorable in about 50 per cent of cases.

Flick and his associates,⁶ in an analysis of 161 cases treated medically, bronchoscopically or surgically, found that eighty-one (50.3 per cent) recovered, forty-eight (29.8 per cent) improved, eight (5 per cent) were unchanged, two (1.2 per cent) recurred and twenty-two (13.7 per cent) died.

F. T. Lord¹ states that abscesses in upper lobes appear to give a more favorable outlook than those in the lower lobes. Flick and his associates⁶ believe that centrally located abscesses are amenable to bronchoscopic treatment, while peripherally located abscesses usually require surgical intervention.

In this series there was one case with a pulmonary abscess in the apex of the right upper lobe which cleared up completely with conservative measures. Another has since been seen in the apex of the left upper lobe, which is, at this time, well on the road to complete arrest. In the conference discussion of these cases, James Alexander Miller recalled a similar case which cleared up completely. He later died of pneumonia and the postmortem examination disclosed that the abscess cavity had completely healed. Apparently pleural adhesions tend to hold the abscess cavity open, allowing aeration, drainage and subsequent cicatrization.

Practically the same number of lower lobe abscesses as of upper lobe abscesses showed improvement. The improvement noted in upper lobe abscess cases, however, appeared much more striking in its rapidity.

CASES SHOWING CLUBBING OF FINGERS.

Early clubbing.....	14
Moderate	10
Fairly marked.....	2
Marked	10
Very marked.....	4
Not definite.....	5
No clubbing.....	32
No note.....	23

The relation to prognosis of clubbing of the fingers and toes, or hypertrophic pulmonary osteoarthropathy, was investigated. This condition, with its thickening of structures of the terminal phalanges of the fingers and often of the toes, is frequently seen in pulmonary abscess. Apparently it does occasionally manifest itself without the presence of any pulmonary suppuration. For example, there is an hereditary type. James Alexander Miller¹ has seen five individuals in one family with this condition. It usually appears well along in the course of pulmonary suppurations and is persistent, but can come on very rapidly and early and disappear rapidly as the pulmonary condition clears up. It would appear that those cases in which there is any more than a slight degree of clubbing are not, as a rule, arrested by conservative methods of treatment. All of the cases in which operative measures were resorted to showed marked clubbing of the fingers.

RELATION OF IMPROVEMENT OR ARREST TO CLUBBING.

No clubbing or early.....	Improved	23
	Unimproved	4
	Died	7
	Undetermined	6
Slight clubbing.....	Improved	7
	Unimproved	3
	Died	1
	Undetermined	5
Moderate.....	Improved	2
	Unimproved	3
	Died	1
Fairly marked.....	Improved	1
	Unimproved	2
	Died	1
Marked.....	Improved (Slight).....	3
	Unimproved	5
	Died	3
Very marked.....	Improved	1
	Unimproved	3
	Died	1

There are some cases improved in every degree of clubbing, but with increase in severity the number of cases drops off, the improvement is less striking and is overbalanced by a greater proportion of cases which were not improved or died.

Complications.—Bronchiectasis was the most common complication of lung abscess. It occurred in eight cases, four of which died. The remaining four were unimproved. Extensive pleuritic changes were noted in four cases, two of which improved. One case was operated on and recurred after drainage from the external wound had ceased. Three cases showed sputa positive for tubercle bacilli. One was a case of old fibroid tuberculosis which broke down, the other two apparently contracted pulmonary tuberculosis during the course of lung abscess.

Two cases which followed pneumonia and empyema with bronchial fistula were drained, healed up and subsequently developed lung abscess. One case developed delirium tremens and promptly died. One was diagnosed as lung abscess complicated by pulmonary syphilis.

Twelve cases were readmitted because of relapse after having been discharged home or to convalescent institutions as improved sufficiently to go on to complete arrest. Of these, nine were readmitted once, two were readmitted twice and one four times. Many of these readmissions became necessary because patients did not take proper rest. A common cold preceded several relapses; in one, bronchopneumonia preceded a relapse. One case, admitted three times, originally had a right lower lobe abscess. On second admission there was evidence of abscess also in the right upper lobe, and on the third admission the sputum was found positive for tubercle bacilli.

Twenty-two cases were operated on; seven improved following operation and fifteen died. Of the fifteen surgical deaths, three postmortem examinations were made. One of these, who had a carcinoma of the right bronchus, has been referred to earlier in this review. Two showed multiple abscesses of the lung which were called bronchiectatic abscesses. In one of these the abscess followed the closure of a bronchial fistula which developed as a result of empyema. The examination of the lung showed one large abscess the size of a walnut, lined with grayish necrotic tissue, situated at the base of the right lung near the hilum. The other abscesses were less than one centimeter in diameter and were classified as terminal aspiration abscesses. This patient died one day after operation. The other case showed, in addition to the multiple abscesses which were four to six centimeters in diameter, a marked bronchiectasis and fibrosis of the right lung which was densely adherent to the pleura. The lower and middle lobes gave a congested, airless, liver-like appearance. This patient died five days after operation. Is it not possible that the many small abscesses found at autopsy might have been the result of a stirring up of infection at the time of operation?

Of the remaining twelve cases, four died from shock shortly after the completion of the surgical procedure; two developed symptoms of brain abscess; one of brain embolus; one of pulmonary embolus, and one died of streptococcus hemolyticus septicemia. Precisely what happened to the other three cases was not stated. One of them, however, was an epileptic and it is possible that his epilepsy might have been a factor.

Eleven cases were deemed suitable for surgical intervention but refused to have any surgery done. The usual indications for surgical interference were:

1. No improvement in the general manifestations of the disease.
2. No improvement in the local condition, as shown by physical signs, roentgen-ray studies and bronchoscopic examinations.
3. A tendency to relapse.

Of the entire series, twenty-three patients have died. The surgical deaths comprise by far the largest percentage, but it must be remembered that these cases were all ones in which it had been predetermined by careful study that conservative measures were of no avail. It is true that they were considered fair surgical risks, but they did not do well. One case, a syphilitic, developed hydropneumothorax following bronchoscopy. One died of delirium tremens; another of aortitis. They were not bronchoscoped. Four cases were complicated with bronchiectasis, and their deaths were in no manner connected with bronchoscopy. One case developed a massive pneumonia and died.

It will be noted that no reference to cure of lung abscess has been made. It is the firm conviction of the writer that lung abscess cases are not cured but are arrested or improved. A period of two years at least must elapse after symptoms have entirely disappeared before a case may be considered permanently arrested. Lynah⁶ expressed this opinion in 1921. Fifty-nine per cent of the cases in this series have been considered as improved or arrested. Many of these are undoubtedly permanently arrested, but the tendency to relapse, even under ideal conditions, has shown itself altogether too frequently. There certainly is a striking similarity between arrested lung abscess and arrested pulmonary tuberculosis, in that both depend largely for the permanent arrest of the disease on prolonged rest and general hygiene. Even after symptoms of active infection have ceased and all physical, roentgen and bronchoscopic findings are negative, a strict routine must be adhered to.

The object of this study has been to give a true account of the cases of lung abscess studied in the bronchoscopic clinic at Belle-

vue Hospital. A group of cases from a large charity hospital has been reviewed from the point of view of the bronchoscopist.

121 EAST SIXTIETH ST.

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XCVIII.

INJECTION OF PARAFFIN INTO A PARALYZED VOCAL CORD FOR THE RELIEF OF APHONIA: CASE REPORT.*

SAMUEL IGLAUER, M. D.,

CINCINNATI.

A patient with a complete paralysis of one vocal cord is often unaware of the condition because the affected cord may be fixed in the midline and the functioning cord approximates it on phonation. However, in some cases of unilateral paralysis the cord undergoes an atrophy and remains fixed in the abducted or cadaveric position. The functioning cord may compensate to some extent by swinging beyond the midline, but if the chink of the glottis still remains too wide the voice is reduced to a whisper and there is great expenditure of the expiratory current with but a minimum effect. Coughing and expectoration are also rendered difficult.

Some twenty years ago Brünings¹ devised an ingenious plastic operation on the paralyzed cord by injecting paraffin into it, thereby increasing its thickness and providing a cushion with which the opposite cord could make contact, with a restoration of the vocal function.

In 1918, Brünings² reported that he had performed this operation on some thirty patients with excellent and permanent results. Others in Germany, including Mayer,³ Wagener⁴ and Amersbach,⁵ have also employed and recommended this method. This procedure does not seem to have been adopted in the United States or England, since I have found no references thereto in the English literature, and for this reason I am reporting a case in which it was carried out.

The technic is as follows: A special syringe (Brünings) and needle through which cold paraffin can be injected is used. Puri-

*Read before the meeting of the American Bronchoscopic Society, St. Louis, June, 1931.

fied sterile paraffin having a melting point of 42-43° C., made up according to Stein's⁶ formula, is melted and introduced into the syringe, where it is allowed to cool and solidify. The larynx is cocainized and the injection made either under direct or indirect laryngoscopy. Most operators prefer the direct method. The needle is inserted into the horizontal surface of the cord a few millimeters from the free border and is pushed into the cord in a downward and outward direction. The first injection should be made at the site of the greatest concavity in the cord. Two or three additional injections are made at different points along the cord, and sufficient paraffin should be injected to straighten the cord and bring it to the middle line. The voice returns immediately after the injections and improves with practice.

As a rule, unless there are special indications, the operation should not be performed until a year has elapsed from the onset of the paralysis. By that time the permanent position of the cord will have been determined and the atrophy completed.

Seiffert⁷ prefers to inject the paraffin through a needle introduced from without through the cricothyroid membrane and guided into the cord under the control of indirect laryngoscopy.

I should like to report the following case, treated by the Brünings technic:

Mr. T., a real estate broker, age 69, was seen in consultation with Dr. H. Vail on December 11, 1930. He complained of regurgitation of food with some dysphagia. The condition had been present and gradually growing worse for some eight or ten years. There had been no impairment of his voice.

Examination revealed the presence of a large pulsion diverticulum of the esophagus.

On January 7, 1931, we performed the first stage operation for the removal of the diverticulum. It required rather forceful retraction on the trachea and esophagus to expose and deliver the sac. Shortly after the operation it was noticed that the patient's voice was impaired, and a laryngeal examination on January 9, 1931, showed some edema over the left arytenoid and left aryepiglottic fold. The left cord could not be seen on account of the overlying edema.

Three days later the patient had no difficulty in swallowing, but he was still hoarse. Examination at this time showed his left cord in the cadaveric position with the left arytenoid tilted forward into the larynx.

On January 19, 1931, the second operation for the removal and closure of the pedicle of the sac was performed. A fistula formed in the neck, but this could be controlled by packing, and the patient was discharged from the hospital.

By January 23, 1931, the voice had improved somewhat and the paralyzed cord was fixed in the midline.

On February 1, 1931, the cord was still fixed in the midline.

By April 5, 1931, the fistula in the neck had closed completely and deglutition was unimpaired. The patient had a persistent whispered aphonia without resonance. He made a great effort while talking and was compelled to stand close to an auditor in order to make himself understood. Examination of the larynx showed the left vocal cord slightly concave and fixed in an exaggerated cadaveric position. The left arytenoid was tilted forward into the larynx. The right cord was freely movable and crossed the midline on attempts at phonation but did not make contact. In consideration of the fixed position of the cord and at the urgent request of the patient who was, figuratively speaking, clamoring for a voice, I decided to inject paraffin into the cord.

On April 7, 1931, this was done under local anesthesia by the indirect method, as described above. The paraffin was deposited in three places in the cord, the largest deposit being placed in the central concavity. The intact cord now made good contact with the paralyzed cord, and there was an immediate return of the voice, which was strong and of good quality.

A few days later the cord appeared somewhat inflamed and edematous, and the voice was somewhat husky.

On April 19, 1931, the patient had a very fair voice and reported that it was better some days than others, which he attributed to changes in the weather. The inflammation and edema had almost disappeared. The cord was slightly nodular near the anterior commissure and there was still a slight concavity in the middle third.

On April 27, 1931, a second injection of paraffin was made in order to straighten out the cord. Immediately thereafter the voice was better than before, and the patient emitted what he called his first "real laugh."

On May 1, 1931, the voice was strong but somewhat thick. Two small hematomata were visible on the cord.

On May 6, 1931, the voice was excellent. Hematomata were still present.

On May 26, 1931, the left cord was still reddened and lay in the midline. The opposite cord approximated perfectly. The voice was very satisfactory, and a phonographic record of the voice was taken.

COMMENT.

Given a patient with permanent aphonia due to a paralyzed vocal cord, there are two recognized methods of restoring the voice, one being the operation devised by Payr⁸ and the other the injection of paraffin. A third method, namely, nerve anastomosis, is still in the experimental stage.

Payr's⁸ operation consists in exposing the thyroid ala and making a trap door in the cartilage overlying and parallel to the affected cord. Upon pushing this trap door into the larynx the vocal cord and arytenoid cartilage are moved to the midline and the voice restored.

The injection of paraffin is a much simpler procedure, but theoretically there are two objections to its use, namely, the danger of embolism, and secondly, the possibility of the development of a paraffinoma. According to Stein,⁹ there have been no cases of embolism reported since cold paraffin has been generally employed. He attributes the formation of a paraffinoma to the former custom of using heated paraffin and to the presence of chemical impurities in the wax. Amersbach,⁵ who has thoroughly reviewed the literature up to 1926, states that no bad results have been reported from intralaryngeal paraffin injections. Eckstein⁹ reports that he has used paraffin injection for various conditions on over 1000 cases during the past 30 years without any disastrous results. He insists, however, that only cold paraffin with a minimum melting point of 50° C. should be used.

In conclusion, it seems to me that in order to restore the patient's voice one is justified in taking the very slight risk attendant upon this procedure. There is practically no danger from embolism, and should a paraffinoma ever develop in a given case the cord could be removed surgically and the patient would be no worse off than he was prior to the injection.

At the time of going to press, September 10, 1931, the patient was re-examined. He has an excellent voice. The paraffin cord is still somewhat congested and is slightly nodular at the sites of the paraffin injection.

707 RACE STREET.

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XCIX.

RECENT DEVELOPMENTS IN THE PROXIMALLY
LIGHTED BRONCHOSCOPE.*

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The art of bronchoscopy, like many another art, depends for its ultimate success on two factors, the skill of the workman and the quality of his tools. The former can be supplied only through natural ability, indefatigable practice and long experience, while the latter is the result of mechanical ingenuity, endless experimentation and the desire always to find some better instrument for the purpose at hand. Instrument dealers' showcases and older bronchoscopists' dusty shelves contain some of the most ingenious products of the human mind, which, superseded by more modern and efficacious ones, no longer recall even the names of their inventors. Through such vicissitudes have passed the instruments which we now designate as the laryngoscope, bronchoscope and esophagoscope, evolved primarily by a few men who are too well known to require mention. Throughout their development, these instruments have shown a definite and persistent tendency to divide themselves into two groups, differing so fundamentally in one important characteristic, namely, the source of illumination, that their adherents form two distinct schools of bronchoscopic technic. Those men who enthusiastically endorse the instrument lighted by a proximally placed lamp are to be found largely in European clinics, while those favoring a terminally placed lamp are, for obvious reasons, predominantly American. In each group are bronchoscopists of great skill, capable of dexterous manipulations with the instrument of their choice.

Viewed from the point of view of our present knowledge of the subject, what are the relative advantages and disadvantages

*Read before the meeting of the American Bronchoscopic Society, St. Louis, June, 1931.

of these two types of instrument, and what are the results that may be expected from their comparative use? It is the purpose of this paper to inquire into this question, and thereby to call attention to the most recent form of the proximally lighted instrument which has so far been devised.

The earliest practical form of the proximally lighted tube was that brought out by Brünings, in 1909, a representation of which appears in Fig. 1. Current furnished to the lamp in the housing caused a beam of light passing through a condenser to be reflected by a mirror down the lumen of the examining tube. Since the mirror was split or divided, it was possible to introduce long instruments, such as forceps or sponge carriers, through the slot and at the same time to obtain a fairly satisfactory view of the tube lumen and the object towards which it was directed. It is quite obvious, however, that the interposition of such an arrangement between the eye of the observer and the lumen of the tube creates for most operators what Mosher has so aptly termed a mental hazard, and is, I believe, the chief reason why this type of instrument has found such scant popularity in this country. Certain men have sought to overcome this objection and still retain the advantages of light rays thrown parallelly down the tube by turning the lamp housing aside or removing it and using a frontal head mirror with which to project the light. This procedure, though successful in some men's hands, necessitates the development of special skill, requires the operator always to maintain a fixed position of the head and fails to give a brilliancy of light attainable with the fixed electroscope.

Only within the last few years have attempts to improve on the Brünings instrument been conspicuously successful. Kahler of Freiburg, Germany, and Haslinger in Vienna, have both devised modifications. In Fig. II is shown the first Haslinger bronchoscope.

By altering the position of the source of light and elevating the mirror, the lighting system is sufficiently diverted to permit a more direct view down the tube and to facilitate manipulation of instruments through it. Nevertheless, the mirror still encroaches to some extent on the line of vision, and the apparatus is clumsy

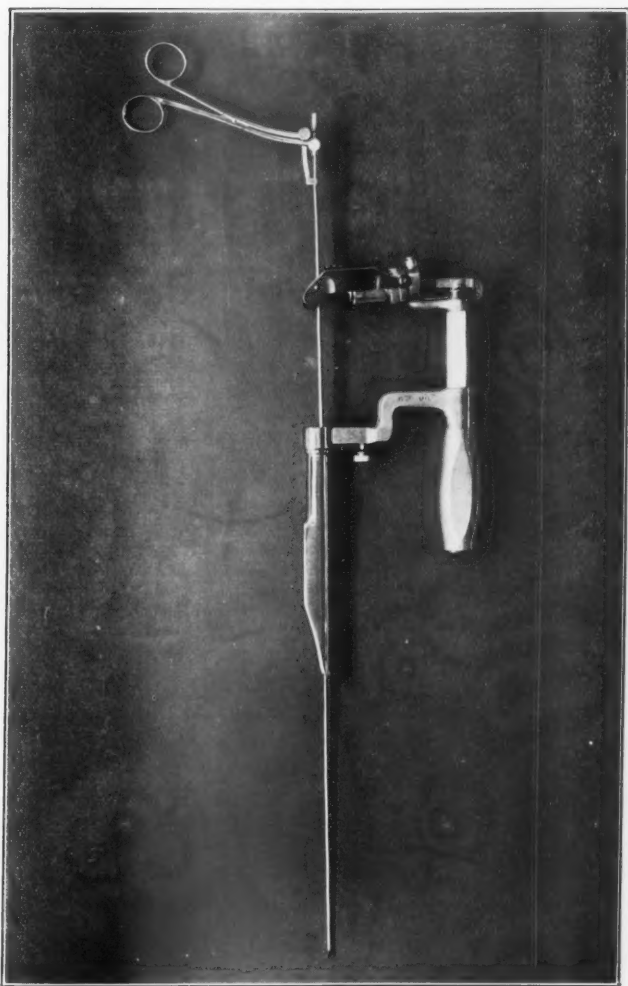


Fig. I. An early form of Bruenings' bronchoscope showing forceps passing through the divided mirror.

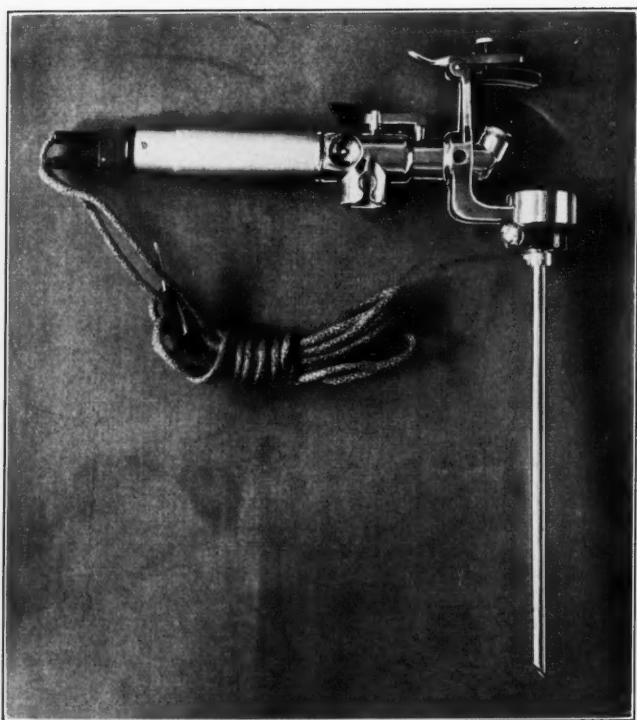


Fig. II. The earlier form of the Hasslinger bronchoscope.

and cumbersome, lacking to a great extent the delicacy of manipulation possible with the distally lighted instrument.

This past winter, during a short stay in Vienna, I visited Hasslinger and was there shown his latest modification of the proximally lighted bronchoscope, the model which I present for the consideration of this meeting. Fig. III shows the assembled instrument, with a bronchoscopic tube attached. Fig. IV illustrates the individual elements in the system, which consist of the lighting cord attached to a 10-volt lamp, the housing containing the condenser and mirror, the handle, attachable either above or

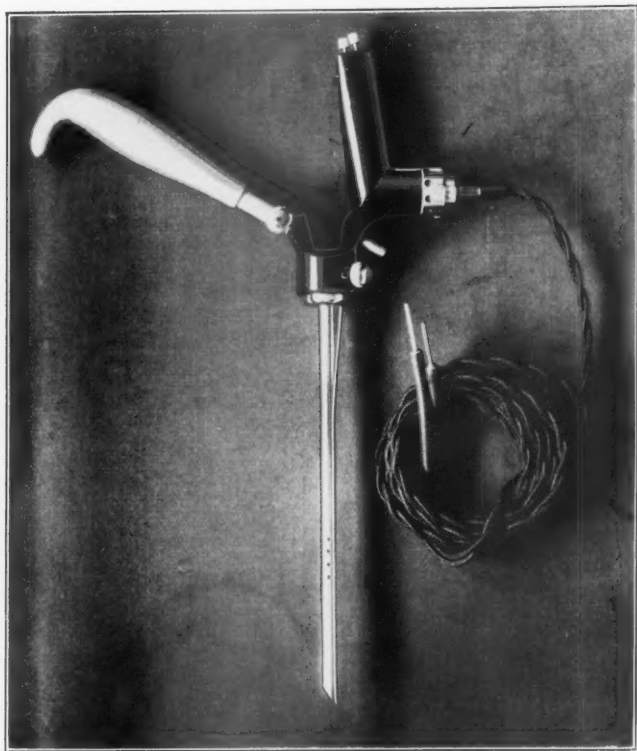


Fig. III. The present Hasslinger bronchoscope assembled.

below, and the demountable tube. It will be noted in Fig. V that whatever disadvantages (and there are several) may be urged against this instrument, this much at least has been perfectly accomplished: there is no part of the apparatus which in any way obstructs the line of vision from the observer's eye down the tube. The lighting system is sufficiently elevated so that the complete tubal lumen is available for instrumentation and observation, necessitating only that the eye be placed at a sufficient distance proximal to the tube to avoid contact with the housing.



Fig. IV. The present Hasslinger bronchoscope, showing individual component parts.

To those operators accustomed to applying their eye to the very end of the distally lighted tube this might seem disadvantageous. Aside from this, the essential objection to the former instrument of this type, interference with the line of vision, has been eliminated.

Fig. VI is a skeletal diagram of the optical system, showing the rays of light passing from the lamp, through the condenser to the mirror and thence reflected down the tube. It is at once apparent, on looking at this arrangement, that the rays of light



Fig. V. Hasslinger bronchoscope with forceps inserted, showing complete clearance along the axis of vision.

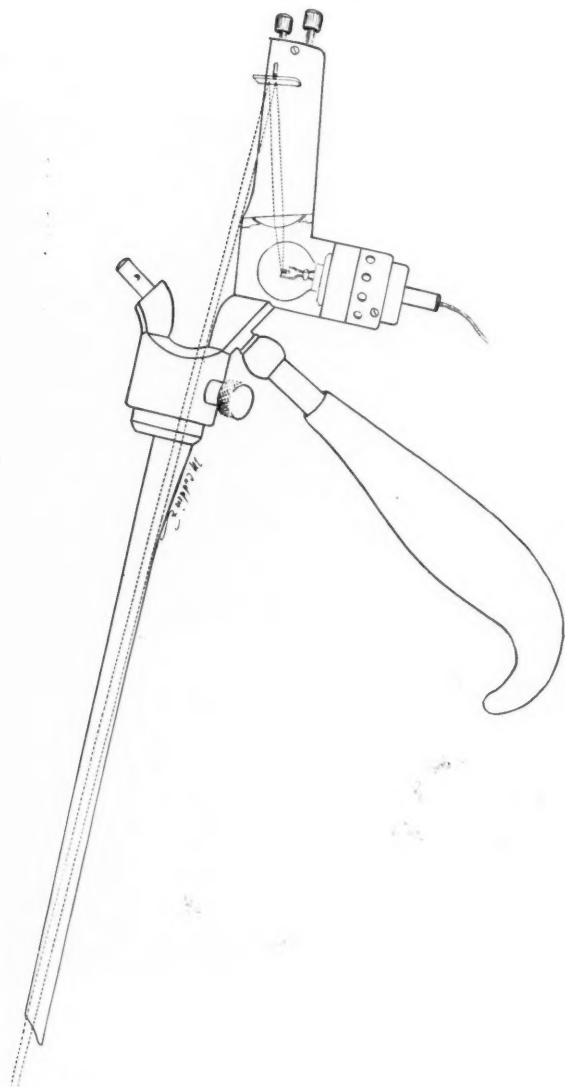


Fig. VI. Schematic drawing showing the optical system of the proximally lighted instrument.

reflected from the mirror are not parallel to the axis of the tube, giving the appearance that the rays are reflected around the corner. This apparent paradox is explained by observing the ingenious modification of the proximal end of the tube where an angulated extension of the lumen is provided, allowing light from the mirror to enter the tube at just enough of an angle to permit rays to pass straight down the tube. It is this device which has made it possible to so elevate the electroscope as to remove it from the line of vision. The mirror's position is changed by adjustable screws behind it, by means of which the beam of light can be accurately centered down the lumen of the tube.

The interchangeable tubes provided with the handle comprise laryngoscopes, bronchoscopes and esophagoscopes of varying lengths and diameters, the greatest lengths being obtained, as in the earlier forms of the proximally lighted instrument, by extension tubes inserted into, and advanced through, the larger and shorter primary tubes. A group of the principal tubes is shown in Fig. VII. On first examining them, and in particular the child-sized laryngoscope and esophagoscope, the operator accustomed to handling distally lighted tubes cannot escape the feeling that these newer instruments are both too large and too heavy for infants and younger children. Prolonged experience alone would serve to dispel this impression, the only answer to which is to be had in the originator's statement that the tubes will fit any patient from the time of birth onward.

Such is the construction of this latest proximally lighted instrument in its essential details. In its present form it is without question superior to any previous instrument using this form of illumination. In comparison with the terminally lighted tubes, what unbiased conclusions may one reasonably draw as to the advantages and disadvantages of each type of instrument? Operators will always prefer to work with a form of apparatus to which they have become thoroughly accustomed and with which they have attained the maximum degree of skill. For these a change to other and unfamiliar tools would be inadvisable and probably unsuccessful. For those who may not as yet be irrevocably wedded to the one or to the other type, it has seemed

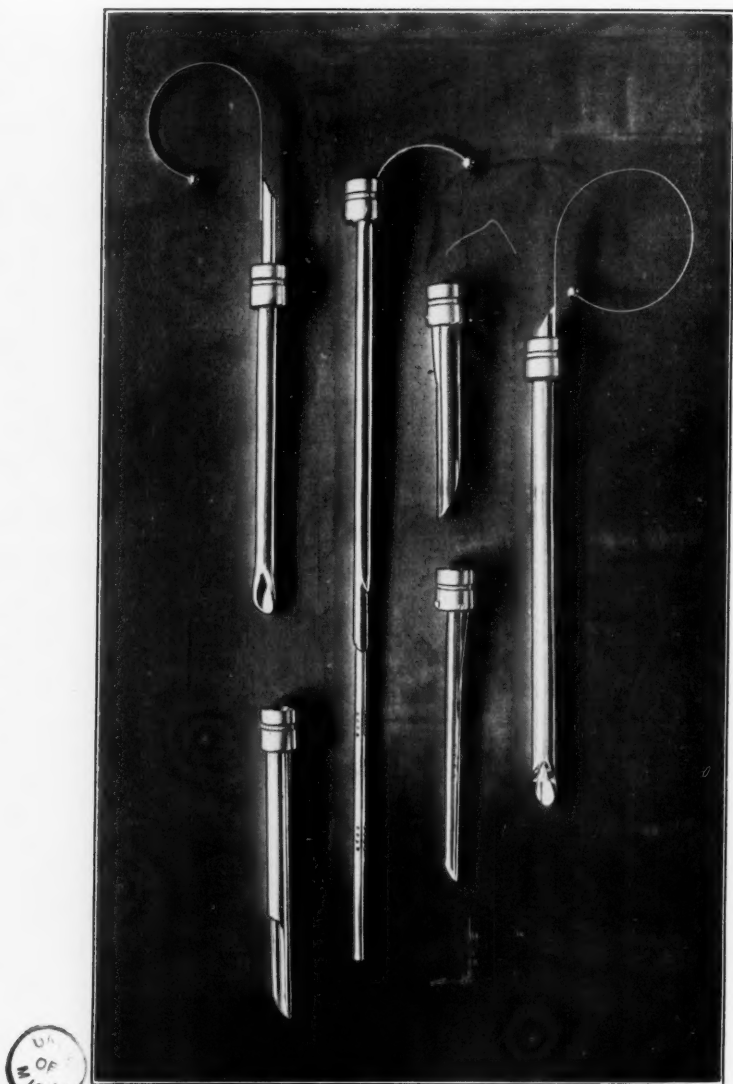


Fig. VII. A group of laryngoscopic, bronchoscopic and esophageal tubes used with the proximally lighted instrument.

to me of interest and value to present some analysis of the two types of instrument, in respect to their individual features.

1. *Source of Electrical Current* (Fig. VIII).—The proximally lighted instrument is supplied with current for its ten-volt lamp from the street current cut down to appropriate strength by some form of rheostat.

The distally lighted instrument is supplied from a group of dry cell batteries.

From the point of view of transportation, the advantage lies with the rheostat, but itinerant bronchoscopy is to be mentioned only to be condemned. Street current may fail, batteries must be replaced, a point for each side. The commonly advanced objection to the use of street current, danger of shock to operator or patient, is said by the originator of the new instrument to be nonexistent owing to perfect insulation. Experience alone could prove this contention to be justified.

2. *Lights*.—Here the advantage rests without question with the distally lighted instrument. The ten-volt lamps are at present difficult to obtain in this country, are much more expensive, and though replaceable in case of burning out during an operation, cannot be changed with the ease of insertion of the extra light carrier.

3. *Lens and Mirror*.—These additional parts make for a complication of the proximally lighted apparatus as compared with the far simpler terminally lighted tube. The mirror may become clouded by secretions coughed up the tube, but so likewise may the distally located light bulb. Certainly the combined lighting system of the European instrument is heavier and less delicately manipulated than is the lighter American form.

4. *The Tubes*.—Multiple detachable tubes with a universal lighting system and handle might be regarded as either a help or a hindrance, according to the point of view of the operator. Since this proximally lighted bronchoscope is intended to be introduced into the trachea, through the larynx, without the assistance of a laryngoscope, only one lighting system is neces-

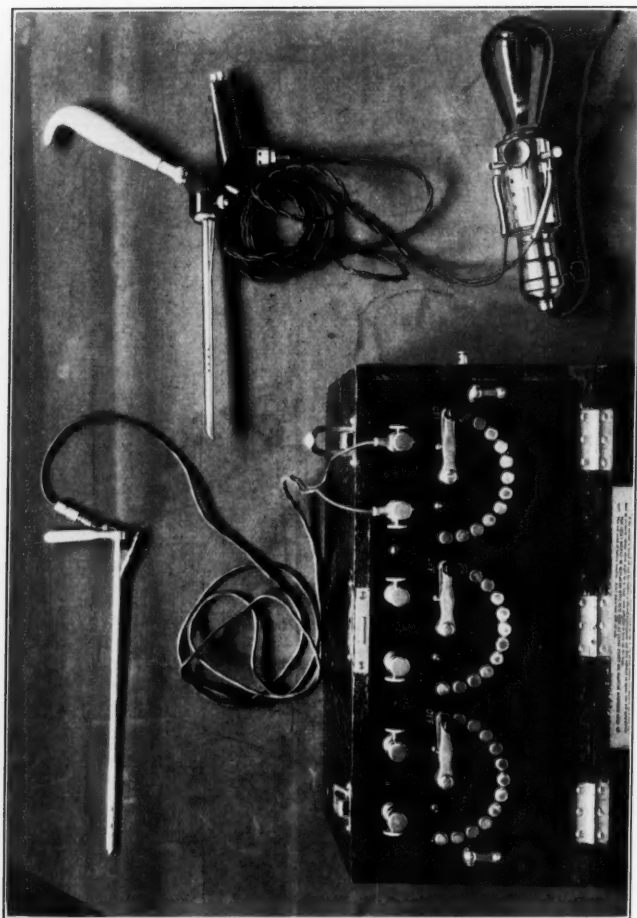


Fig. VIII. A view showing the two different lighting systems of the proximally and distally lighted instrument.

sary. Except for one thoroughly trained in this manner of introduction, it would seem that, at least in children, the difficulties of insertion of the tube would be greatly increased without preliminary laryngoscopic exposure and fixation of the larynx. In the esophagus, the manner of insertion of the tubes is the same for the two types of tube.

All of the proximally lighted tubes are full-lumen, due to the elimination of a light carrier and a suction tube. In this respect a considerable advantage lies with the European instrument, since not only is the internal diameter of the tube increased but at the same time the external diameter of the tube decreased. Taking the 5 mm. terminally lighted instrument and its proximally lighted counterpart, we have the following figures:

A 5 mm. distally lighted bronchoscope has an external diameter of 26 F.

A 7 mm. proximally lighted bronchoscope has an external diameter of 25 F.

One might contend that the absence of the suction tube is a disadvantage, though the writer's experience has been that the greater amount of hindering secretions must be removed with an independent suction tip inserted into the tube. Certainly the largest possible internal diameter with the smallest possible external diameter is a highly desirable objective.

All of the so-called master tubes of the new instrument are relatively short, none over 25 cm. in length, obviously too short for examination of terminal structures. This situation is met by the use of a sliding secondary internal extension tube, inserted within the master tube and pushed down it to a maximum distance, depending on the individual tubes.

For one not thoroughly accustomed to the use of such a tube this arrangement proves a considerable stumbling block. There is a feeling of insecurity and some awkwardness in advancing the inner tube instead of the instrument as a whole. The end of the extension is cut squarely across and has a relatively sharp edge, with the possibility of some trauma except under the most cautious manipulations. Advantages of the extension tubes, as

claimed by their supporters, are that the master tube will serve for easier investigation of near by structures, while distant ones may be seen with insertion of the extension, whereas in the case of distally lighted tubes, individual long and short instruments are required, with separate introductions of each. Uncertainty as to the ideal length of tube to be used is thus avoided.

5. *Light Projection.*—It is in regard to this feature of the new instrument that the most enthusiastic advantages are claimed by its supporters. Considering this point, Brünings himself, in 1909, wrote as follows: "A theoretical analysis of the question of illumination shows that distal lamps are best adapted to 'cystoscopic' purposes, by which is meant the inspection of globular cavities. These require a diffuse illumination of extensive surfaces situated perpendicularly to the line of sight. On the other hand, 'syringoscopy,' that is to say, the inspection of tubular cavities (esophagus, bronchus), requires a light of great penetrative power, in order that the various points of the organ, situated at different distances in the line of sight, may be illuminated as equally as possible. This is necessary for the accurate orientation of the bronchial tree, and this is considerably facilitated when it is possible simultaneously to see extensive tracts with their various lateral branches. It has, moreover, to be remembered that in many stenoses and in the finer bronchi in which the tube itself cannot be introduced, it is only possible to see by means of a projected light, and this must be of great penetrative power. There can, therefore, be no doubt, theoretically, that a parallel radiating proximal lamp is superior in respect of penetration to any kind of distal lamp. It also offers various advantages in practice, for distal lamps in all cases conceal a large portion of the field of vision which in the case of narrow tubes amounts to more than one-half. Moreover, such lamps are soiled by the slightest secretions, and must be constantly changed in the course of an operation."

Exaggerated as some of these statements appear, the superiority of the proximal illumination in respect to projection of light beyond the tube cannot be denied. In Fig. IX are shown the two types of instrument, as if inserted into the bronchus containing a

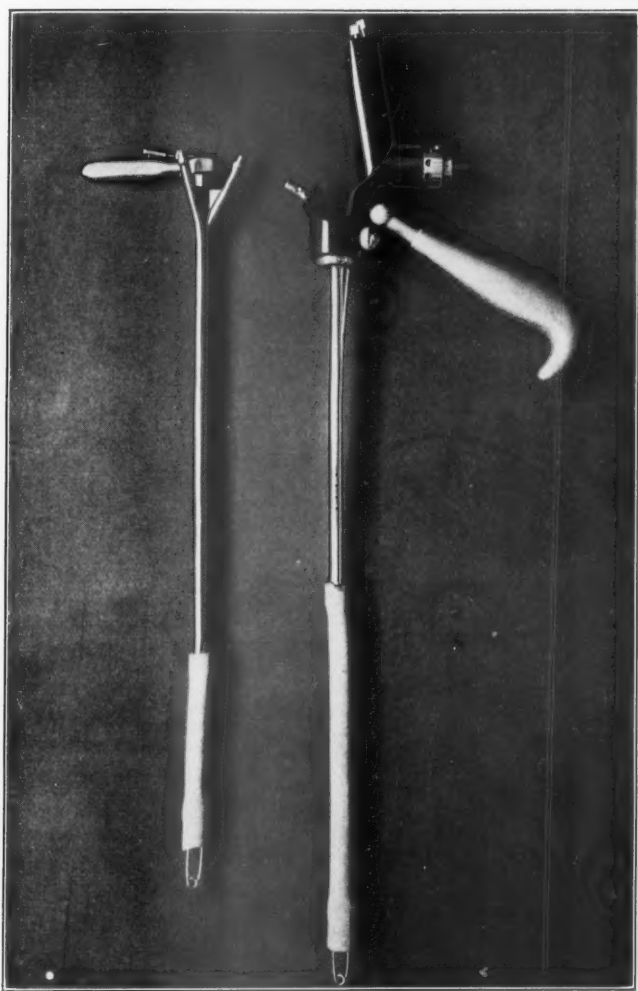


Fig. IX. The comparative representation of the distance at which a foreign body, equally well illuminated, can be seen with the two types of instrument.

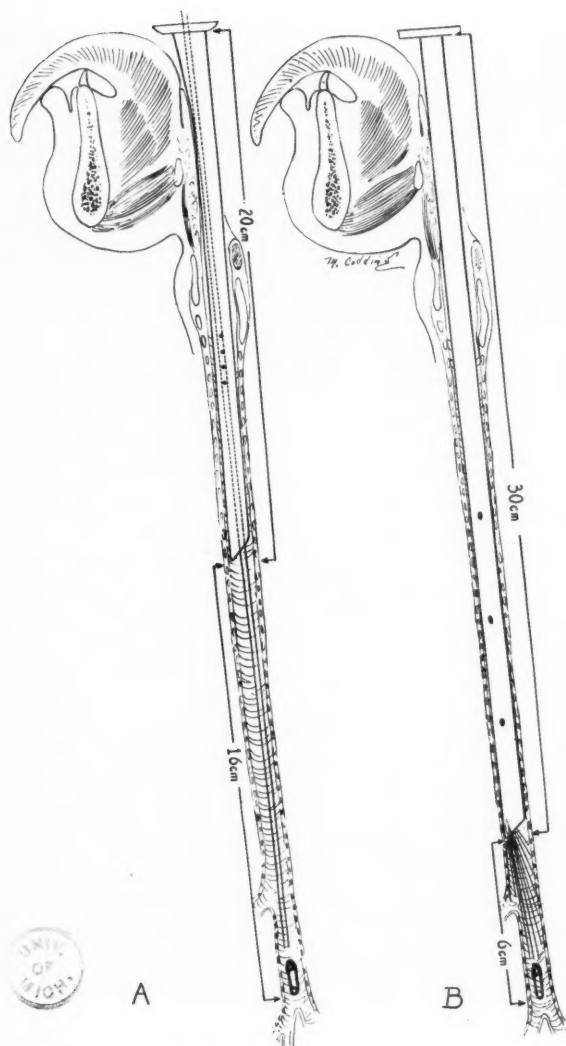


Fig. X. Graphic representation of the situation shown in Fig. IX.

foreign body. The difference in length of the two "bronchi," represented by rubber tubing, represents the difference in light projection of the two systems, with essentially equal illumination of the foreign body. Fig. X illustrates this principle more accurately and shows that with a foreign body equidistant from the mouth it is necessary, in order to secure adequate illumination, to advance the distally lighted instrument within 4 cm. of the object, as against 16 cm. in the proximally lighted tube. Since the lumen of the bronchus might easily be too small to accommodate the distally lighted tube at this depth, it would be necessary either to use a smaller tube or be content with less brilliant illumination.

The advantages of this extended light projection may, however, be more apparent than real. It will be noted that in Fig. X the two tubes of essentially the same diameter are of unequal length, the distally lighted tube being some 10 cm. longer. It is often of the greatest help in foreign body work to be able to bring the end of the tube in close contact with the foreign body, both as a manipulative aid and likewise as a protector of a sharp point or cutting edge. This procedure might be impossible in the case of the shorter tube, and it would be necessary, after grasping the object with forceps, to draw it through an area of bronchial wall unprotected by the tube, with possible resultant trauma.

In addition, the very useful forceps light reflex is of course absent in the proximally lighted instrument.

Considering such light projection, one wonders what its limits are, and if, with the use of an extension tube, equally satisfactory illumination can be secured as with the terminally lighted tubes of 40 to 45 cm. in length. Fig. XI brings out the remarkable elasticity of this light projection. Here, with an extension tube which lengthens the instrument to 45 cm., a foreign body, 60 cm. from the tube mouth can be clearly seen, surely the maximum distance at which one would ever be called upon to work. A foreign body, 15 cm. from the end of the 45 cm. distally lighted tube, is practically invisible.

Such, then, are the essential features of this newer proximally lighted instrument. It would seem to have advantages and dis-

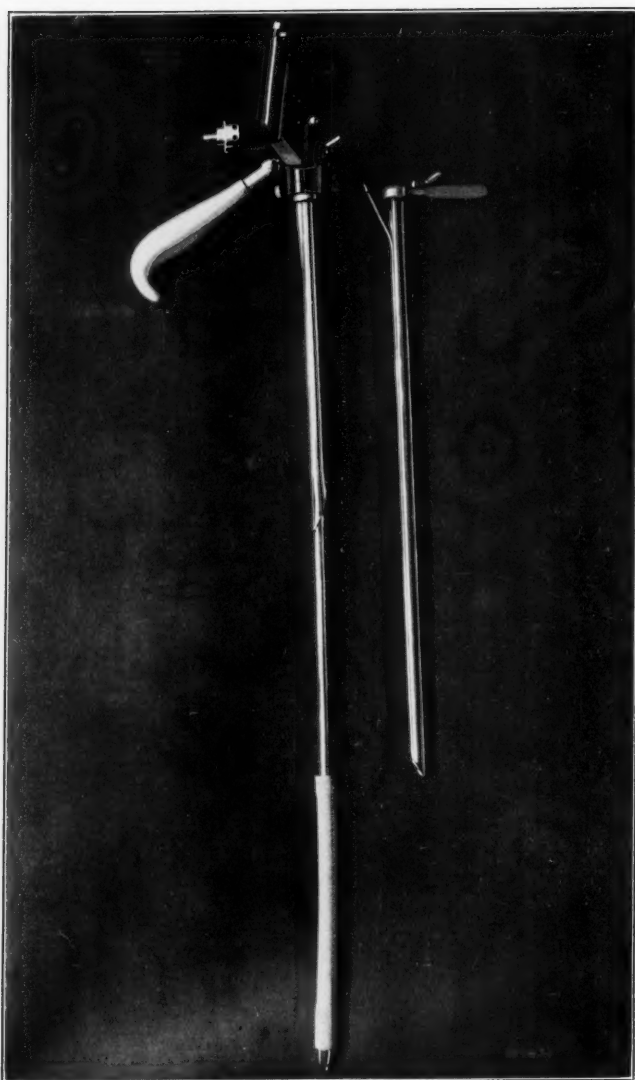


Fig. XI. A photograph to show the extent (60 cm.) to which light can be reflected with the proximal instrument to reach a distant foreign body.

advantages in comparison with the distally lighted tube to which most of us have become so accustomed as to make us loth to give it up. Some familiarity with both forms of instrument is probably the ideal situation, with selection of each for a particular object. Certainly it would appear that for any operator who prefers proximal illumination the instrument of Haslinger is far superior to any others of its type.

319 LONGWOOD AVE.

Progress in Otolaryngology, 1930-31.

C.

I. DIAGNOSIS AND PATHOLOGY.*

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ST. LOUIS.

It is a rather difficult matter to present to you an accurate account of ideas which are truly progressive, for the fact of today may tomorrow prove to be the fancy of yesterday.

After perusing the literature one is struck by the large number of publications which at first glance appear to be original, but on closer scrutiny are mainly confirmatory. And yet, is that not a manner of progress? While it has gotten to be axiomatic, in this day of feverish striving, that to stand still is to retrogress, nevertheless each new opinion, each new proof that is added to a relatively unstable fact serves to make that fact all the more stable, serves to age a foundation stone upon which must be slowly built the temple of our knowledge of the science of otolaryngology. For, so relatively immature is this science, that we are as yet only testing the tensile strength of those girders which are to comprise the framework of the superstructure.

As careful as we are, our development is going to be a constant process of tearing down and building up, not with the malign spirit of the iconoclast, but with the higher motive of conscientious striving for better knowledge, which is the keystone of true progress.

This is beautifully exemplified in the human body itself, where we find dead and dying bone acting as a chemical stimulus, that newer and stronger bone may be formed.

We must constantly caution ourselves lest our enthusiasms so blind our judgment that we find ourselves becoming incapable

*From the Department of Otolaryngology, Washington University School of Medicine.

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of distinguishing fact from fancy, incapable of realizing that our conclusions may often be the results of "the wish being father to the thought," and not of sound logic. This frequently does happen. Let us, by all means, pursue conservatism in thought and in action, lest the science of otolaryngology suffer from the fads and fancies that are constantly arising. In our zeal to progress it is indeed well to keep before us the time honored adage, "Be not the first by whom the new is tried, nor yet the last to put the old aside."

One often hears it stated that "textbook" cases of certain diseases are rarely seen. Nevertheless we would do well not to let ourselves be consciously or unconsciously weaned from our textbook diagnoses, for there is much in diagnosis that is alleged to be new which is but a reincarnation of a thought from the oft-thumbed pages of an old textbook.

While newer diagnostic methods are being devised, they are, as a rule, not basic, but, strictly speaking, diagnostic aids. As such they are not intended and should not be depended upon to bear the full weight of the responsibility as the final arbiters in the decision. If such be the case, we are bound to be led into error more often than not, and the method itself likewise dragged into disrepute, no matter how sound it may essentially be.

In bringing to your attention the following subjects we do so with the full realization that time and space prohibit a more comprehensive survey, that it is but the "status quo" of which we speak, and that the last word is yet to be said regarding these and many other equally important innovations.

RADIOPAQUE OILS.

These have proven of inestimable value in sinus diagnosis. They are used by being injected directly into the maxillary antrums and sphenoids, or introduced into all the paranasal sinuses by the displacement method of Proetz. This is accomplished in the following manner:

1. The patient's head is inverted so that the chin and the external auditory meatuses are in the same vertical plane.
2. Radiopaque fluid is instilled into the nose (a total of 4 cc. in each side at two separate intervals).

3. Negative pressure (180 mm.) is applied intermittently to one nostril, while a finger closes the other and the patient closes the pharynx by saying "K."

4. The patient is returned to the erect position.

5. The X-ray pictures are taken immediately to determine the degree of filling of the sinuses, and again at 24, 48 or 72 hour intervals to determine the emptying time.

The advantages and disadvantages are discussed by Proetz in his recent excellent monograph:

"Displacement has its advantages and disadvantages. It is particularly suitable to the filling of the posterior series of sinuses and is here to be preferred, with rare exceptions, to other methods. While the anterior ethmoids permit a scattered filling and do not present the characteristic dense outlines of the other cells, they are by nature small and scattered, and are incapable of filling by any of the other methods. The extent to which the antrum may be filled by displacement depends entirely upon the relation of the ostium to the cell in the position of filling. The frontal sinus is the most difficult to fill by displacement. Owing to its long and tortuous hiatus, air bubbles are not readily displaced from this sinus.

"Displacement has three distinct advantages over other methods of filling. The first is that, since it depends upon gravity, the fluids themselves seek out and enter cells, no matter where they lie. It is often a remote cell or one unusually placed which is the center of trouble and which is never discovered by other methods. Second, it accomplishes its filling without contact of instruments, and hence without trauma. Third, it results in a general filling which is necessary for the estimation of relative drainage time."

The method requires sufficiently frequent usage to familiarize the operator and the roentgenologist with the exact technic and correct interpretation of the X-ray plates.

ALLERGY.

The diagnostic significance of the incidence of eosinophiles in the nasal secretions in allergic conditions is being constantly confirmed. Some workers state that they rule out allergy definitely if no eosinophiles are found in the nasal secretions during an

attack of a catarrhal rhinitis. Others feel that this attitude is too extreme, as there may be phases in a true allergy in which these cells may be absent. In other words, while the finding is confirmatory it is not infallible.

The microscopic examination of the antral secretion is of interest. The smears occasionally revealed large numbers of eosinophiles, but more frequently the differential count was not found to be remarkable. The thickened lining so frequently reported in the antrums of patients having asthma or vasomotor rhinitis offers one chance in nine of harboring pus pockets and therefore of itself being a focus of infection.

The histopathologic changes in the tissues of the nose and sinuses are characteristic only in that there may be somewhat more edema of the tunica propria and a certain amount of eosinophilic invasion. These latter states, however, are transient, consequently tissue removed from the nose or sinuses during a quiescent interval may resemble microscopically that found in any chronic hyperplastic sinusitis. It is interesting to note the microscopic findings in the nasal mucous membrane of a guinea pig dying in induced anaphylactic shock, in which the tunica propria showed marked petechial hemorrhages, congestion and eosinophilia.

The cutaneous tests have proven unsatisfactory in perennial hay fever and in multiple sensitive individuals. Heredity is considered more important in these types of cases.

LABORATORY AIDS.

The blood picture in infections about the nose, throat and ear is receiving a great deal more attention than hitherto. The advent of the Von Schilling method of differentiation of the white blood cells has given this aspect a new impetus and has enlisted the serious consideration of many otolaryngologists in a way that the Arneth method, its predecessor, failed to do on account of its intricacy. The significance of the "shift to the left" of the blood picture is being appreciated, and more case reports of infectious mononucleosis and agranulocytosis are appearing in the literature. Boies very succinctly and aptly describes this hematologic reaction: "The total leucocyte count and the ordinary differential

estimation are not reliable indications in otologic infections of the intensity of an infection or of the resistance of the patient to the toxemia resulting from this infection. The response of the bone marrow to the effect of a bacterial toxin results in the presence of immature neutrophilic leucocytes in the blood stream. There results a change in the quality of the neutrophils which are considered to be the active factors in the resisting force. The percentage of these immature neutrophils reflects the presence and the intensity of the infectious process. The numerical relation of these cells from day to day gives an accurate indication of the trend of the toxemia, thus knowledge of the patient's resistance, and light on the question of prognosis." The consensus of opinion of other men who have worked with the blood picture is that it is also a valuable aid in determining the presence of intracranial complications but that it is of very little value in differential diagnosis.

The Sedimentation Test.—This study of the settling power of red cells, a general biologic reaction akin to fever, has received some attention from those interested in hematology; and they have concluded that there is very little differential value in the test. Nor can any operative indications be drawn from the study of blood calcium relative to the amount of bone destruction in mastoiditis.

Many other more intricate methods of laboratory diagnoses have been pursued, affirming or denying other hypotheses, but they are too numerous or too technical to warrant inclusion at present.

However, we as otolaryngologists primarily and ultimately interested in and responsible for making the correct diagnosis, should at least familiarize ourselves with the interpretation of such laboratory aids as have proven of value, so that we may be able to intelligently evaluate these aids with our other physical findings. This is of equal importance with the personal interpretation of X-ray plates.

X-RAY.

A distinct advance in X-ray diagnosis of mastoiditis in infancy has been contributed by A. Granger. This may help to

clear up the controversy as to the correct time to operate upon infants suffering from an otitis media with or without certain coincident systemic manifestations.

He believes it possible to diagnose radiographically two degrees of mastoid pathology in infants under one year of age (1) with infection giving rise to occlusion of the mastoid antrum by pus, or inflammatory or bloody exudate the mastoid antrum is opaque on X-ray; and (2) with extensive mastoid destruction the sinus plate is exposed, and in the X-ray the sinus wall is visible. In infants over one year of age three degrees of mastoid pathology may be seen: (1) with infection and occlusion of the antrum the X-ray shows opaqueness of any cells, but the osseous structure and cell walls are still visible; (2) with additional softening the osseous structure and cell walls are no longer clearly visible; and (3) with extensive mastoid destruction the sinus wall is visible when it should normally not be (infants, two years old or less).

THE COMMON COLD.

This malady, which has always been a serious problem to the medical profession, has now become a very vital one to the economists and the business world in general on account of the large number of working days which are lost by those suffering from the common cold and its complications, sinusitis, otitis media, mastoiditis, intracranial complications and pneumonia. The statement that more time is lost by workers from this affliction than from all other illnesses combined is probably not the least exaggerated. Our helplessness is directly traceable to our lack of knowledge concerning the etiologic agent or agents, despite the fact that unceasing efforts are being directed towards the solution of this problem.

The theories extant at present are two, that it is caused either by bacteria or by a filtrable virus.

J. E. Walker, in 1929, makes the following statement: "Colds are not due to any one specific virus, but are reactions that can be brought about by many different bacteria. These bacteria are the organisms commonly cultured from colds, and comprise staphylococci, streptococci, pneumococci, influenza bacillus, M.

catarrhalis, Friedländer's bacilli, and possibly others. This hypothesis is definitely opposed to the idea that a specific filtrable virus is the primary cause of colds, and that the ordinary bacteria are to be regarded merely as secondary invaders."

In conclusion, the author states that the infections due to *B. influenzae*, *B. bronchisepticus* and *M. catarrhalis* differed from acute upper respiratory infections occurring under natural conditions only in the history of the preceding accidental or experimental inoculation. It would, of course, be unwarranted to assume that a specific filtrable virus accompanied all three of these organisms. The observations are believed to place the hypothesis of the bacterial origin of colds on a fairly firm basis. Added weight is given to this view by the work of Robertson and Groves, who, in an extensive series of experiments, were unable to confirm the previously reported experiments of other authors relating to the rôle of a filtrable virus in colds.

Robertson and Groves summarize their work as follows:

"In this series of experiments nasal secretions were secured from eleven persons suffering with acute uncomplicated coryza. After being diluted and passed through a Berkefeld filter, these secretions were sprayed onto the nasal mucosa of 100 volunteers.

"The experiments presented no convincing evidence indicative of a filter-passing organism as the exciting factor in acute coryza. We believe the cases recorded as positive to be the result of factors independent of the inoculations.

"During an attack of coryza definite variations were noted in the bacterial flora of the secretions. During the onset and early stages of the attack there was a marked diminution of the total bacterial flora, with an equally marked predominance of one of the normal habitants—usually *staphylococcus albus*.

"During the purulent stage of the attack a marked increase of all organisms over the normal flora of health was observed, although the predominance of one organism still remained. The later stages of the attack were marked by a gradual return to the normal flora of health."

The filtrable virus theory has many firm followers, among them Olitsky and McCartney, whose work in 1923 brought forth the following conclusions: "The transmission of a clinical condition

similar to typical, infectious common cold from man to man with the filtered nasopharyngeal washings of early cases of the disease indicates that the excitant is filtrable."

Experiments on rabbits with these secretions and cultivation tests show that the materials derived from patients with common colds are distinct in effects from those of epidemic influenza. Cultivations of the nasopharyngeal washings from forty cases, and from lung tissue of inoculated rabbits, having failed to reveal any constant, pathogenic agent or incitant. None of these cultures yielded *B. pneumosintes*.

This has likewise been ably defended and actually placed on a firmer basis than at any previous time by the latest work of Shibley, Mills and Dochez.

They describe a filtrable virus as being "one of those mysterious agents the exact nature of whose biologic activity still remains obscure."

Using young chimpanzees because of the fact that anthropoids are susceptible to the human type of upper respiratory infection, they found that the clinical picture of the nasal infection is similar to that observed in human beings, and the bacteria in the throat have been discovered to be strikingly similar in man and in the ape.

Before the experiments were started the chimpanzees were placed in strict quarantine and a rigorous surgical technic was employed by the workers who came in contact with them. The securing of material and preparation of the filtrate was carried on as follows: "Nasal washings from the subjects with colds were obtained by running slightly warmed buffered meat infusion broth into their nostrils and thence out through the mouth. From 10 to 20 cc. of broth was gargled and added to the nasal washing. The material was then passed rapidly through a Berkefeld V filter. The unfiltered washing was cultured aerobically and the filtrate anaerobically on blood plates, blood broth and Smith-Noguchi medium. As a further control, 0.25 cc. of filtrate was injected intracerebrally or intracisternally in rabbits in order to exclude the presence of herpes virus. As soon as possible after filtration of the nasal washing, 1 cc. of the filtrate was injected with careful aseptic precautions into each nostril of the quaran-

tinued chimpanzees." From these experiments on twenty chimpanzees they have reached the following very definite conclusions:

"The contagious cold in human beings is caused by an invisible, uncultivable, filtrable agent which, in all likelihood, belongs to the group of so-called submicroscopic viruses. Colds can be transmitted successfully from man to the chimpanzee and from man to man by means of Berkefeld filtrates of nasal washings obtained from individuals suffering from spontaneous colds, more especially during the period of rising incidence of infection in the community. These experimental colds resemble in all respects colds spontaneously contracted in the natural environment. In apes, one of the significant effects of infection with the filtrable agent is the stimulation into greatly increased activity of any potential pathogen that may happen to be present in the upper respiratory flora. This we regard as of great importance, since it seems to explain the marked secondary activity in the respiratory tract of such organisms as pneumococci, streptococcus hemolyticus and Pfeiffer's bacillus, which leads to the severe sequelae which sometimes follow the common cold and influenza. In fact, the most important significance of viruses of this type seems to lie in their capacity to incite activity on the part of the more dangerous pathogenic organisms that infect the upper respiratory tract."

A more recent concept of the filtrable virus theory has been elaborated by Arthur I. Kendall as the result of his experiments in the Department of Bacteriology at Northwestern University Medical School.

His conclusions, in part, are:

"1. A procedure is formulated for inducing at will both a filtrable and a nonfiltrable state in bacteria. Mention is made of a series of experiments in which both the filtrable and the nonfiltrable state has thus been induced in a series of well known bacteria comprising a variety of types.

"2. It is postulated that a majority, if not all, known bacteria can and do exist in a filtrable and in a nonfiltrable state.

"3. A preliminary report of the isolation of microbes in the blood, not only of cases of influenza but also from common cold, rheumatic fever, arthritis, from staphylococcus bacteriophage

and Besredka's staphylococcus antivirus is presented in evidence of the ubiquity of the procedure."

We are aware that this theory of an ultra microscopic stage in the life cycle of certain bacteria is not new, but these latest developments, including in this class such large numbers of other bacteria, especially those associated with the "common cold" and influenza, mark a very valuable contribution to our knowledge.

Thus we are left to draw our own conclusions, being still at a loss to explain the predisposing factors in the human body which make the upper respiratory cells permeable to the invasion of the causative factor of the clinical "cold." Do chilling of the body, excessive fatigue, grief and improper, unbalanced diet all act in the same manner? Or is it some atmospheric change in electrical potential which affects the permeability of the cells?

BACTERIOLOGY.

Crowe and Polvogt state that a culture made by swabbing the surface of the tonsil is a reliable index of the predominating organism in the crypts, as a result of their observations following the examination of tonsils removed at 100 operations in which the hemolytic streptococcus was the predominating organism grown in 91 per cent and the staphylococcus in 8 per cent, there being no growth in one case.

The normal maxillary sinus was found not to contain bacteria. Though the washings may be bacteriologically negative, bacteria may be present in the membranes. However, the bacteriology alone does not account for the development of chronicity. It is important to think in terms of circulatory changes resulting from local vascular pathology, allergic states, vitamin and endocrine imbalance.

PATHOLOGY.

The large numbers of excellent contributions to the literature have been the gratifying results of the recent stimulation of interest in this phase of otolaryngology. The larger research centers have encouraged those who have shown an interest in particular problems by offering unlimited laboratory facilities, material aids and whole-hearted co-operation.

While many opinions and conclusions have been apparently contradictory, it is more often a confusion of terminology or a difference in interpretation of findings than an actual divergence of opinion. This confusion is necessarily unavoidable until such time as frequent interchanges of opinions and material will bring about a uniformity of thought concerning the essential elements of this special pathology.

In an effort to determine how and when the mucous membrane of the sinus regenerates, Knowlton and McGregor removed the mucous membrane lining the antrums of dogs, killed at various intervals postoperatively, and microscopic study of the antral tissue was made. The experiment showed the following results:

1. Anatomically and histologically, the dog's antrum is well adapted for experimental study.

2. One month after the antral lining is removed, epithelial regeneration is well established and bone formation begins.

3. Three months afterward, epithelial regeneration is complete, and the canine fossa opening is nearly filled in with bone.

4. Five months afterward, gland regeneration is well established, and the mucoperiosteum as a whole looks almost normal.

5. The human antral sections thus far examined show that the same processes occur in man as are here shown in the dog.

Contrasted with this picture is that presented by Kistner following operations upon the sinuses of human beings. These sinuses were infected, while those of the dogs used in the Knowlton and McGregor experiments were presumably not. I think that it must make a difference. Kistner concludes:

- "1. The typical features of a hyperplastic ethmoid cell are presented. Hyperplasia in a sinus mucosa is one of the usual structural changes found in chronic latent or nonpurulent sinusitis. Whether it is of bacterial origin or due to an underlying allergy or vitamin deficiency, it exhibits epithelial or connective tissue proliferation. In patients in whom this type of sinusitis was associated with, or presumed to be a contributory factor in, a systemic disease we found these tissues to contain pathogenic organisms.

- "2. The mucous membrane of the paranasal sinuses has a definite characteristic architecture. Even when modified by patho-

logic changes, it retains all of its structural elements. It should not be confused with nasal mucosa. The sinus and nasal mucous membranes differ greatly in histologic structure, organization and appearance. After complete destruction, the sinus mucous membrane does not regenerate its structures; instead there is a process of repair and bone proliferation. The walls of the cavity are lined by a layer of granulation tissue, variable in thickness, which eventually organizes and forms typical scar tissue. This becomes covered by an epithelium of variable character, determined by its place of origin and influenced by its distance from the ancestral epithelium."

Coates and Ersner working with dogs demonstrated that the regeneration of the mucosa in normal frontal sinuses occurred in a manner similar to that shown by Knowlton and McGregor in the maxillary antrums—that is, the first replacement membrane resembled the original in all respects. However, the second replacement membrane deviated from the normal in that it was thicker and showed more connective tissue cell and general cellular infiltration—in short, a picture of an infected membrane, and more on the order of that reported by Kistner but in an earlier stage.

OTOSCLEROSIS.

Despite the intense and widespread study of progressive deafness which is being pursued, nothing new has developed to aid us in the early diagnosis of otosclerosis. Our inability to successfully cope with this distressing condition rests on our not being able to make a sufficiently early diagnosis. However, the apparent increase in the numbers of such cases is a tacit tribute to our progress in this study. With the vast amount of material for histopathologic study that is accumulating in certain centers equipped to handle it, it is simply a matter of time before we shall have a great deal more valuable data at our command. Guild has contributed the following observations, which mark a distinct advance in our knowledge of this condition:

"1. Otosclerotic changes may begin as early as the end of the first year of postnatal life, a much earlier age than has heretofore been demonstrated.

"2. The exact location of the first appearance of the area near the anterior margin of the oval window is not the same in all cases.

"3. The fissura ante fenestram is not always involved in the beginning of the pathologic process.

"4. Before ankylosis occurs a sulcus in the surface of the otosclerotic area near the margin of the oval window is frequently present, and this sulcus is filled with dense fibrous tissue which extends across and fills the intervening space between the wall of the fossa and the oval window and the medial end of the anterior crus of the stapes.

"5. In some cases, at least, ankylosis begins by the formation, growth and coalescence of scattered areas of calcification in this dense fibrous tissue, as well as in the annular ligament.

"6. An area of otosclerosis may arise near the anterior margin of the oval window, grow to considerable size and become quiescent without the formation of any calcified connections to the footplate of the stapes.

"7. Ankylosis must be well started before a clinical diagnosis of otosclerosis is possible by the present methods of examination."

Dissipating the idea that mesenchyme is found in the middle ear and mastoid only before and shortly after birth, Crowe and Polvogt have found the following conditions:

"1. Mesenchyme may persist in certain portions of the middle ear and mastoid throughout life. The niche of the round window, the epitympanum or attic and the mastoid antrum are the usual locations.

"2. In such cases the tympanic membrane is normal on clinical examination and in the histologic sections. The presence of abnormal embryonic tissue in the middle ear cannot be recognized from an inspection of the drum.

"3. Histologic study of the temporal bones of the cases reported demonstrates an abnormal condition in the middle ear (a large amount of embryonic tissue) and an atrophy of the nerve and organ of Corti in the inner ear, which is limited, however, to the lower half of the basal coil. In this, as in similar cases studied, no definite lesion to a blood vessel could be found which would account for the changes in the nerves and end organs.

"4. Persistent embryonic tissue in the middle ear in adult life is not rare, and in time the perfect combination may appear that will enable us to determine how much, if any, impairment of hearing results from the conditions in the middle ear." By the perfect combination they mean "(1) a good clinical note on the appearance of the drums, and history in regard to the hearing and infection of the ear; (2) a satisfactory tuning fork test; (3) an audiometer test, made under the most favorable conditions for accuracy; (4) a postmortem examination soon enough after death to insure good histologic results; (5) good fixation—decalcification and embedding; (6) the inner ear normal for the function tests and in the histologic sections; the middle ear uncomplicated by infection."

MASTOID INFECTION.

Histopathologic studies of infected middle ears and mastoids have shown that simultaneous infection exists most markedly in the subepithelial tissue of the mucosa of the eustachian tube, middle ear and mastoid cells, and that it probably spreads along these routes and through the vascular channels, as evidenced by the marked perivascular infiltration with polymorphonuclear leucocytes, monocytes and round cells, rather than through the open air spaces of the eustachian tube, middle ear and mastoid air cells alone. This hypothesis is likewise confirmed by the finding of mastoid cells filled with hyperplastic mucosa, and others with pus, interposed between distantly separated air-containing cells, and further substantiated by the rapidity of spread of infection throughout a mastoid structure, the periostitis without an adjacent underlying pus-containing cell, and the frequency with which an infected mastoid is encountered on the same side as an infected sinus, especially a maxillary antrum.

Thus we come to realize that from year to year there is very little progress made in diagnosis, but from decade to decade a great deal.

634 N. GRAND BLVD.

CI.

II. MEDICAL AND SURGICAL TREATMENT.*

GORDON F. HARKNESS, M. D.,

DAVENPORT, IOWA.

The purpose of these lectures, as I understand it, is not for the presentation of personal work or ideas. One cannot epitomize everything of worth that appears in our literature. Indications for treatment properly belong to diagnosis, yet one cannot intelligently mention treatment and not consider anatomy, physiology and symptomatology. The recent intensely interesting studies of the blood I have not considered, because they are extraterritorial, as it were, and it seems primarily diagnostic.

From a culling of the literature I have selected certain subjects. This is the personal element and for its shortcomings I ask your indulgence.

IMMUNITY.

There is probably no question in the general field of medicine in which otolaryngologists have as great an interest as that of immunity. There is probably no field in which there is at the present time so much uncertainty. The study of immunologic problems is being carried on by trained laboratory workers who have developed new processes of investigation, nomenclatures and descriptions, so that the reading of articles often leaves the ordinary clinician in a daze and with little understanding of what it is all about.

Friedberger and his co-workers in Berlin argue that defensive antibodies are formed and increased in children as a result of a general maturation law and that mass immunizations to transmissible diseases are not due to previous subclinical infections. This is based partly on the lack of antibodies in umbilical blood acting against sheep and rabbit erythrocytes, and their later de-

*Presented as part of its educational program before the American Academy of Ophthalmology and Otolaryngology, French Lick, Ind., September 17, 1931.

velopment as the child grows. Those who controvert the theory claim that the stimulation of antibodies by habitual foods must first be disproven.

Russian observers—Wygodtschi Koff and Manuilowa—working from the known fact that diphtheria bacilli change in morphology, toxin production and virulence when grown in association with streptococci and using the phagocytic index, claim to have shown that the associated streptococci acquire a quasi-diphtheria specificity and that the same is retained in isolated culture even unto the twelfth generation.

What the study of engrafting new type specificities to organisms will amount to is problematical.

Dr. Hirayma has shown that guinea pigs infected with tubercle bacilli are more resistant to bacillus anthracis. Clinically, tuberculous individuals show a relatively low influenza morbidity. Hanger demonstrated that chronic infections by a single strain of organisms excites cellular reactivity to many strains of bacteria unrelated biologically. To those of us who were raised on Ehrlich's "side chain theory" we are as babes lost in the wood.

Quoting Kolmer (Clinical Medicine and Surgery, July, 1931): "The effect of vaccines is both specific and nonspecific. Specific effects refer to the production of antibodies and are almost alone responsible for the prophylactic value of active immunization. Micro-organisms vary greatly in their vaccinogenic activity. Nonspecific effects refer to the production of fever, leukocytosis, an increase of the nonspecific bactericidal substances of the blood and the promotion of phagocytosis, and probably play some part in therapeutic immunization."

Within our own circle, Novak particularly has called attention to the ideas advanced by Besredka regarding immunity. The latter argues for the cellular theory of immunity and believes that antibodies have a subordinate position, being the digestion products of the interaction between bacteria and phagocytes. By means of his antiviral, cells (skin cells in anthrax) are desensitized to a particular organism. Later when inoculation with the organism takes place, the cells not being sensitive, no reaction, as evidenced by inflammation, takes place and the organism is forced

into a saprophytic position and as such undergoes phagocytosis, largely by the macrophages of the reticulo-endothelial system.

The best clinical results reported so far are by the injection of the antiviral intradermally. One-fourth cc. is injected, gradually increasing to 1 cc. at three-day intervals. It is essential that the injections be distributed so that no subsequent injection shall be within six inches of a previous one, in order to obviate a reaction of local tissue immunity known as the Artruss phenomena, which consists of a slight area of necrosis.

The status of antiviral treatment (Besredka) is by no means established, and its real evaluation, it is hoped, will soon be before the medical profession.

Quoting Kolmer: "Nonspecific protein therapy is still largely on an empiric basis. The mechanism is unknown, but the production of fever along with quantitative and qualitative changes in leukocytes, with an increase of nonspecific bactericidal substances of the blood and of phagocytoses and focal reactions of hyperemia and exudation, are regarded as being of most importance."

Joseph Beck (Laryngoscope, February, 1931) concludes that foreign protein therapy in acute pathologic conditions has not been encouraging. He also states that the chill which has been supposed to be of prime importance he rarely observed.

Nonspecific therapy is, of course, not confined to the protein. In a preparation called omnadin, there is a combination of the proteins of nonpathogenic bacteria, lipoids of bile and fat. There is no general and very little local reaction. The advantages of its use, as pointed out by Mithoefer (ANNALS OF OTOTOLOGY, RHINOLOGY AND LARYNGOLOGY, March, 1931), are a mild reaction of the cellular elements and no general reaction, as often happens with the use of the milk preparations. Also it apparently never excites anaphylactic symptoms. That it does excite a mild leukocytosis is easily demonstrated. Just how and what else it accomplishes must be judged on an empirical clinical basis.

ANESTHESIA.

Local Anesthesia.—A. F. Laszlo, in the March issue of THE ANNALS OF OTOTOLOGY, RHINOLOGY AND LARYNGOLOGY, calls attention to a modification of the use of cocaine solutions that has

proven satisfactory at the New York Post-Graduate Hospital. This modified cocain solution, to be used as a topical anesthetic, is based principally on the work of Gehse, who demonstrated that the addition of phenol materially increases the anesthetic properties of cocain as well as making the solution more stable.

The Gehse standard solution is—

Cocain sulphate.....	2.00
Phenol.....	.35
Normal saline	100.00

The advantages of this solution, as used by and proven to the satisfaction of the staff of the New York Post-Graduate Hospital, are as follows:

1. Anesthetic effect of cocain increased from five to ten times.
2. Anesthetic effect occurs much more rapidly.
3. Duration of anesthetic is materially increased.
4. Reduction of toxicity, due to smaller amounts of cocain used.
5. Increased stability of solution.
6. Sterility of solution itself and the disinfectant effect of the phenol helps to sterilize the operating field.
7. Economic saving in the cost of cocain.

No explanation is offered as to the reason for this synergistic action of phenol in combination with cocain.

General Anesthesia.—The desirability of a general narcosis by means other than through the respiratory tract is evidenced by various nonvolatile substances that have been advocated.

Two avenues of administration, the intravenous and the rectal, are used for various types of nonvolatile anesthetics. The use of the barbiturates has increased greatly in the last few years. The intravenous administration of sodium amytal, which may be taken as an example of any of the barbiturates, has a most profound and intense effect upon the individual. Once given, its administration cannot be recalled and, while there is a prolonged period of narcosis following its use, return to consciousness may be accompanied by a most undesirable period of excitation.

Of rather recent introduction is another alcohol—tribromethyl-alcohol—known as E 107, or Avertin. Willstatter and Duesberg first prepared this substance from bromal in 1923. Clinically it

was first used as an anesthetic by Eichholtz and Butzenberger in 1926. Indicative of the widespread interest aroused, Lundy's article (Mayo Clinic, Vol. 4, 370-380, Dec., 1929) has attached a bibliography of 176 papers dealing with Avertin.

Of more than passing interest to us at this meeting is the fact that the first surgical procedure carried out on this continent with Avertin was an esophagoscopy by our guest of honor, Dr. Joseph C. Beck.

The recorded cases of Avertin anesthesia have passed the half million mark.

There is almost a unanimity of opinion that some form of preliminary hypnotic should be used, the choice varying from morphin, some form of the barbiturates, scopolamin and morphin, morphin and atropin or pantapon.

It is now considered more properly a basic anesthetic. Ten grams is a maximum dose for any individual. The dosage that was generally recommended was from 120 to 150 milligrams per kilo of body weight. Females and children take a higher dose in proportion to body weight. Very nervous people tolerate higher doses, particularly the toxic thyroid patients.

Chemically the drug is ethylalcohol with three bromin atoms introduced into the formula. The pharmacologist, while granting the bromin to be less dangerous than chlorin, immediately thinks of chloroform. Avertin acts as a respiratory rather than a cardiac depressant. The pharmacologist explains the difference because of the different method of introducing the drug into the system. By inhalation, chloroform may overwhelm the heart muscle; absorption through the rectal mucosa does not permit this and the toxicity of Avertin is expressed as a respiratory depressant. The difference in toxicity may be due to the difference of administration.

Absorption is rapid, according to Straub of the Pharmacologic Institute of Munich—80 per cent in the first twenty minutes and 95 per cent within two hours.

Electrocardiographic tracings by Unger and May revealed no essential heart muscle changes. The pulse is slightly accelerated, rarely beyond 100.

Animal experimentation has failed to show any changes in the parenchymatous organs. Alterations in blood chemistry are not clinically significant. Ephedrin and epinephrin will overcome a prolonged fall in systolic pressure. Eye reflexes are absent and pin-point pupils remain with an overdose of the drug. Since the excess thyroxin in the toxic goiter patient detoxicates the drug, thyroxin has been suggested in cases of toxicity.

Carbon dioxide is recommended to combat respiratory embarrassment.

Avertin produces amnesia, narcosis and anesthesia in the order named.

What are the advantages of its use?

1. The production of an amnesia whereby the patient never retains even the slightest memory of his operation. The horrors of the operating room do not exist.

2. The induction is most pleasant.

3. Excellent muscular relaxation.

4. Elimination of mental stress.

5. Absence of psychic shock.

6. Absence of irritation to the respiratory tract.

7. Less interference with surgical technic, particularly about the head.

8. Usefulness in long operations where deep anesthesia is not necessary.

9. Absence of vomiting or coughing during administration of the basal anesthesia or the supplementary ether.

10. Reduction in the amount of ether.

11. Absence of excitement.

12. Obliteration of the functional element, although true pain reflexes may persist.

13. A great boon to the nervous, high-strung patient.

14. Analgesic action after operation.

15. Quoting Dandy: "Ether in intracranial surgery causes swelling of the brain, postoperative vomiting and pneumonia. Avertin does not and materially aids in the approach."

16. Absence of headache.

17. Lasting sleep after operation.

18. Practical elimination of nausea and vomiting. The addition of amylene hydrate has seemed, from some reports, to slightly increase the incidence of a postoperative state of excitement.

What are the disadvantages?

1. A higher death rate than from ether.
 2. The great care necessary in preparing the drug and the ease of decomposition.
 3. Prolonged postoperative sleep, if this is not desired.
 4. Initial depression of circulation.
 5. Cyanosis at times.
 6. Withdrawal of anesthetic not practical.
 7. Anesthesia cannot be lightened.
 8. Obstruction to respiration by a tendency to falling back of the tongue.
 9. The recovery period of about three hours shows a return of corneal reflex, indicating a light sleep.
 10. Cases must be watched constantly during postoperative sleep.
 11. In those head cases where the danger of postoperative bleeding is most likely to occur, particular watchfulness is required to protect the respiratory tract.
 12. Contraindicated in destructive lesions of the liver, extreme cachexia, acidosis and advanced pulmonary tuberculosis.
 13. Contraindicated in impaired kidneys.
 14. Contraindicated in inflammatory conditions of the rectum.
- In conclusion, we have in Avertin a basal anesthetic that, for the selected type of case, fulfills a real need but cannot be expected to displace ether, a routine anesthetic in the medical world.

ALLERGY.

Because of the fact that the discomfort of the patient is often manifested in laryngologic and even otologic fields, as reported by Proetz, advances in the treatment of allergic conditions are of great interest to the otolaryngologist. There is a great deal of theory as to cause. According to Kolmer, the cellular theory has a wider acceptance than the humoral theory at the present time. The term hay fever has become obsolete, being supplanted by pollen disease. With asthma there is a greater diversification

of causative factors, the foods and a multitude of substances. The rôle of the carbohydrates is not to be denied, and even the metals and temperature changes seem capable of producing conditions at least akin to an allergic state.

Bacterial allergies seem to be accepted as a fact, at least by more workers than formerly. Successful treatment should be based on primary causes. Until these are settled more definitely, treatment will lack the foundation it should have. The rôle of the sympathetic nervous system is a factor, not a cause. Stern and Spiracke (*Jour. Allergy*, 1-357, May, 1930), in a study of the effect of the extrinsic nerves of the lungs on status asthmaticus, stimulated the sympathetic trunk between the level of the second and fourth intercostal spaces on the right side by an electrical current in a patient subject to bronchial asthma, and induced an attack. On blocking this region the attack cleared up almost immediately and completely. The connection of the nasal mucous membrane, through sympathetic fibers that cause it to act as a trigger zone, as advocated by Hazeltine, is verified at times by individual cases.

Walle, in reporting the pathologic studies carried out at the Anaphylaxis Clinic under the auspices of the Harvard Medical School, concluded that the thickened antral lining so frequently reported in patients having asthma, offers about one chance in nine of harboring pus pockets and acting as a focus of infection.

The practical clinical influence of the presence of an allergy has had a profound effect on the indications for nasal and sinus surgery. Hansel's work on the histopathologic changes that occur in the nose and sinuses in allergy substantiates the need for a conservatism that has gained rapid ground. The eosinophilic infiltration in the mucous membrane of the nose and sinuses and the occurrence of eosinophiles in the nasal secretions should direct one's treatment primarily to the allergic condition. Infection that may be present may demand some surgical relief. Sufficient proof has not been forthcoming that bacteria are the primary invaders. Surgery to restore function and eliminate infection is conceded, but the writer would offer a protest against radical sinus surgery in asthma that attempts to remove all tissue that microscopically appears pathologic. To support this protest, if there is one part

of the field of otolaryngology that is discredited in the minds of the laity, it is their impression of the clinical results obtained the country over by the radical sinus surgery of the past few years.

Secondly, the initial relief to the asthmatic may be obtained by various procedures. Among the older otolaryngologists present, I doubt if there is one who has not had the experience of giving temporary relief to the asthmatic by removal of a nasal spur or the tip of a turbinate. So reports of immediate improvement following radical sinus surgery are not *prima facie* evidence that the operative desideratum has been obtained.

Thirdly, if there is a regeneration of mucous membrane lining the sinuses, as Mosher has claimed, and demonstrated in some cases, which partakes of the same characteristics as the original membrane, what is to prevent the allergic patient from again becoming a candidate for radical surgery? F. B. Kistner (*Arch. of Otolaryn.*, Feb., 1931), from his experimental work, denies that sinus mucous membrane regenerates after complete destruction.

The diagnosis is the successful treatment of allergy, and the first essential of a successful allergist is to become a medical Sherlock Holmes. Haphazard methods mean failure. To those in the larger centers, where there are men who will take the time to develop a deductive ingenuity and make intensive eliminative studies of the patient, his habits and environments, will the best results be obtained. To many, however, the patient in his own mind is a rhinolaryngologic case, and the man he consults has no one better or as well qualified to care for his allergic needs, and necessity forces him to become a sort of allergist.

To sum up the practical side of allergic treatment as it has progressed today:

Skin tests may be misleading; the sensitiveness of the skin and the mucous membrane may vary either in a positive or a negative way.

It is better to eliminate certain factors, irrespective of reactions, as feather pillows, orris root in cosmetic powders, etc., and house dust, as far as practical.

To one depending on the commercial manufacturers for his pollen antigens, the new packages whereby you make your own dilutions is a distinct advance. It takes about five days for the

antigen to be excreted. Treatment is individualized and accumulation is not a great factor in the beginning with the weaker dilutions. Treatment can be accelerated in the beginning, but as the units per dose get higher, greater intervals of time between the treatments are necessary. In asthma elimination rather than desensitization is gaining recognition as the most desirable type of treatment. Yet medical practice must be practical, and I recall an allergic young lady who suffered her asthmatic symptoms when her admirer, a swain whose work brought him in contact with horses, came to pay his respects. Her sensitization to horse dander was most pronounced. Relief was obtained by desensitization, for it was not practical to eliminate the young man.

Elimination diets, regardless of skin reactions, should be tried, thinking first of wheat, milk and eggs. According to Alexander, eggs are the one food in which desensitization offers the more practical solution.

Duke calls attention to the constitutional reactions that may follow the administration of pollen extract. He advocates a method based on the contention that prolonged pollen reaction or epinephrin reaction is due to the prolonged distribution of these agents from the site of the inoculation rather than to a prolonged effect of a given quantity in the general circulation at a given moment. The control of pollen and epinephrin reactions is accomplished by the use of the rubber tourniquet applied above the site of and just prior to the injection of the pollen. It is applied tightly enough to cut off venous return but not arterial flow. It is frequently loosened and reapplied for at least five minutes after the injection, the release and reapplication being made at thirty-second intervals, gradually lengthening the same.

There are yet many things to be explained regarding the allergies. Dosage has its influence and multiple allergic factors may exist. They may, in part, explain the departure of the individual from a balanced allergic state. Yet why does an individual have a balanced allergic state for years, then suddenly develop symptoms of allergy? Or again, why does the allergic patient have periods of quiescence without any known environmental changes? Such problems have not as yet been satisfactorily answered to the satisfaction of many interested in the subject.

MUEK'S TEST.

The limitations of this essay are confined to medical and surgical treatment and, while the epinephrin probe test, as devised by Muek (*Arch. of Otolaryn.*, Nov., 1930) is primarily a diagnostic measure in traumas of the skull and brain, it is medical in its diagnostic application. Corroboration of this test has been made by Weiss, Lunedei, Joel and Thiessing. Muek first published this test in 1924, then more from a physiologic standpoint.

Quoting Muek, the technic follows: "The mucosa covering the nasal concha is rendered slightly ischemic with a 1:1000 solution of epinephrin and shortly afterward a probe is passed over the mucosa of the inferior nasal concha; a transient reflex dilatation of the blood vessels occurs. In pathologic conditions, however, a vasoconstriction is produced by the passage of the probe over the mucosa, and a white streak appears that persists from two to fifteen minutes or even longer, after the blanching of the rest of the mucosa, due to the epinephrin, has begun to diminish or has disappeared."

He found this vasoconstrictor reflex phenomenon regularly in the presence of arterial spasm in the brain. This test is based on a disturbance in function of the vascular fibers of the sympathetic in the region of the head, brain and neck. The white streak sign is an indicator of the tone of the nerves that innervate the blood vessels of the brain. This is made possible because of the blood supply (the relationship between the internal carotid artery and its branch, the ophthalmic; secondly, the relationship of the carotid artery and the sympathetic nervous system; thirdly, the peculiar vascular anatomic structure of the inferior concha). These facts, together with the fact that the superior cervical ganglion is a center of vasoconstriction.

This sign may occur, even though the cranial trauma occurred several decades before. It is an enduring symptom and hence its evaluation in post-traumatic symptoms requires great care.

Hemispherical location of lesions and of tumors is claimed for this test. Muek feels a certain regularity exists and that disturbance of the vessels of the pia, after excluding syphilis, Ménière's disease, epidemic encephalitis and lead poisoning, will cause this

vasoconstrictor phenomena to lateralize in the nose on the side of the brain injury or tumor. Time alone will definitely establish the position of this test. It has great value if substantiated.

EPINEPHRIN AND EPHEDRIN.

Topical applications to the nasal mucosa is such an everyday occurrence in otolaryngology that logical reasons for or against certain medicaments so used is of importance. Fox ("Chronic Effect of Epinephrin and Ephedrin on the Nasal Mucosa," *Arch. of Otolaryn.*, Jan., 1930), in animal experimentation, demonstrated the action of epinephrin and ephedrin on the nasal mucosa when daily spraying of same was continued for a period of three months, his conclusions being based on the microscopic examination of the tissues. With ephedrin there was noticed a slight exudation containing polymorphonuclear leucocytes, with very little denudation of the epithelium. There was no free blood in the tissues and the lymphatics and blood vessels were normal. With epinephrin there was considerable antemortem denudation. Greater infiltration of the mucous membrane and some intra-epithelial abscesses; free hemorrhage into the substantia propria occurred and the presence of newly regenerated tissue gave evidence of chronicity.

Fox (*Archives of Otolaryn.*, Feb., 1931) made further animal experiments to observe the after effect of the single spraying of these substances upon the nasal mucous membrane, which substantiated the above observations.

SINUSITIS.

The subject of nasal sinusitis still finds otolaryngologists divided into different camps, but the general trend is toward a conservatism. In the words of H. I. Lillie, "We are beginning to place our work on more of a physiologic basis than an anatomic one. The histopathology found in the allergies has been a factor in this." Quoting Hunt ("Rational Surgical Treatment of Chronic Antra Disease," *Canada M. A. J.*, Sept., 1930), "A large percentage of all chronic nasal catarrhs and many remote systemic diseases are directly due to chronic sinusitis, the antrum being the largest and, most frequently involved, and the Caldwell-Luc is

the only operation that takes proper cognizance of the pathology and of its removal." One finds editorial exception from G. E. Shambaugh (Year Book, 1930) to the beginning premise and to the removal of lining membrane simply because it is thickened.

Further editorial comment is excited by the studies of C. F. Wright ("Radical Maxillary Sinus Operation," Arch. of Otolaryn., July, 1930). Wright found in nineteen out of twenty secondary radical antrum cavities, mucous membrane that had regenerated. He further was not able to make observations that would correlate definitely the patient's symptoms with the pathologic picture. The editorial exception was that justification for operation is largely from the annoyance of persistent discharge, pain and discomfort being relatively rare and the danger from systemic infection being extremely rare.

Fenton (ANNALS OF OTOLGY, RHINOLOGY AND LARYNGOLOGY, Dec., 1929), in discussing the radical treatment of the ethmoid (intranasal), advocates methodical and cautious procedures, doing too little rather than too much. He advocates a willingness to await results and by repeated operations to extend the operative field as symptoms justify the same. In contradistinction, Mithoefer (personal communication) feels that the disrepute of nasal accessory sinus surgery is due to a lack of thoroughly analyzing our cases prior to simple operations on the nose, and for that reason there is often a failure to uncover hidden foci of infection. He feels there is a master sinus to be looked for and the pathology eradicated with one operation. He contends that seldom can the intranasal ethmoid operation be performed thoroughly and that following failure of intranasal surgery and the patient suffering from more headaches or asthma, the external ethmoid operation is indicated.

One could continue to quote pro and con, but by and large a cautious and conservative attitude with respect to the nasal accessory sinuses by otolaryngologists the country over seems to be gaining ground.

The use of radiopaques as a diagnostic measure in the displacement method, as advocated by Arthur Proetz, is beyond the scope of this presentation. In the medical treatment of sinus disease, however, the displacement method offers possibilities that

only the future can justify. Medical intrasinus treatment has been woefully inadequate. The displacement method does offer a means other than surgical that we have never before had of introducing fluids within the sinuses. It is to be conceded that a good proportion of comparatively recent sinus infection can be eradicated by adequate drainage and ventilation. The medical treatment of sinusitis, to date, by the displacement method does not rely on the introduction of antiseptics, since there are none which are nonirritating to the sinus mucosa.

Regarding solutions that can be used in the displacement method, Proetz has found that for simple cleansing of the mucosa isotonic salt solution accomplishes as much as the various alkaline solutions and with a better tolerance on the part of the lining membranes. Lubricants at times relieve sinus irritations. Relief from headache has followed lipiodol used in a diagnostic way. The use of vegetable oils has a disadvantage because of their becoming rancid. Light liquid petrolatum or the phenol-iodin petrolatum combination are to be preferred. The latter combination has been particularly helpful in ozena.

Since the purpose is to aid nature and since it is the blockade at the ostia that tends to prevent physiologic restoration, the addition of some vasoconstrictor is indicated. Ephedrin sulphate, .5 per cent, in physiologic salt solution, has proven the most effective solution that opens and maintains the ostial openings.

Particularly in nasal sinusitis of children, as one scans the literature, is one impressed that the otolaryngologist must first be a physician. It is as much a pediatric as a rhinologic problem. Time does not permit quotations from writings of men familiar to you. Whether the infection is primary or secondary to an endocrin imbalance, insufficient vitamin intake, an allergy or toxic absorption from a disturbed gastro-intestinal tract, are all part of the therapeutic problems. Certainly the infection is not due to specific bacteria; most any pus producing organism may be found. The progress, as the writer sees it, is that all the above factors are being considered more sanely. Each factor is granted an influence, without undue emphasis on any one, and the treatment or ventilation of the antrum by simply a window if necessary

is but a part of a prolonged, well directed regime which attempts to correct general body imbalance.

NASOPHARYNX.

It is not within the province of this paper¹ to discuss Tornwaldt's disease from an anatomic standpoint and to enter into the distinction between inflammation and pus from a true pharyngeal bursa or pus coming from an abscess within the remnants of adenoid tissue. Yankauer (*ANNAS OF OTOTOLOGY, RHINOLOGY AND LARYNGOLOGY*, 39:481, 1930) makes a distinction and attributes most of the cases formerly recorded as Tornwaldt's disease as nasopharyngeal abscesses characterized by a swelling in the recessus media.

The progress value of his paper emphasizes the fact that we do have means of approaching the nasopharynx by direct inspection, either by means of his direct speculum, by the Beck method with rubber tubes or through the pharyngoscope. Direct inspection of the nasopharynx is a neglected procedure.

The pain in peritonsillar abscess is such that any means to relieve the same makes an appeal to every laryngologist. M. R. Guttman ("Alleviation of Pain in Peritonsillar Abscess," *Arch. of Otolaryn.*, April 1930), has called attention first to the fact that most peritonsillar abscesses are located in the superior and anterior part of the tonsillar area; secondly, that this region is innervated by the palatine branches of the fifth nerve that pass through the sphenopalatine ganglion; thirdly, that the topical application of 10 to 20 per cent cocaine solution applied to the lateral wall in the vicinity of the sphenopalatine ganglion will control pain and cause the incision in the abscess to be made with little discomfort to the patient.

TONSILS AND ADENOIDS.

We bid fair to become a tonsillectomized nation, and yet careful observations given the opportunity to judge the results obtained over a period of years do not substantiate the claims of many enthusiasts, and it becomes the duty of the otolaryngologists to acquaint their medical brethren of these facts so that the operation of tonsillectomy may be placed on a more rational basis, not only in their eyes but also in the minds of the laity.

Probably the most extensive survey after a ten-year period is that reported by Kaiser (J. A. M. A., 1930), on 2200 tonsillectomized children.

Of rather striking significance is the report of Shambaugh, Hayden, Hagens and Watkins (Arch. of Otolaryn., 12:190, Aug., 1930), that in a large group studied the approximate ratio of those without palpable evidence of disease of the middle ear in tonsillectomized children was as 13:23, and in those retaining their tonsils as 15:26. Their conclusions were that disease of the tonsils and adenoids can be responsible for some deafness only when it has produced otitis media which has invaded the labyrinth, a negligible factor in their statistics.

Watson-Williams (Lancet, 1:792, 1930) calls attention to the pharyngeal abscess, "a quinsy that isn't," where abscess tends to point low behind the faucial pillar and at which point it is opened with a blunt instrument.

The question of the choice of anesthetic and the incidence of the two outstanding complications—deep cervical infection and lung abscess—have been considered in the case of the former by S. L. Shapiro (Arch. Otolaryn., June, 1930). He reported 80 cases of deep cervical infection and the fact that in 94 per cent a local anesthetic was used.

In contrast, Clerf (Arch. Otolaryn., Feb., 1930) reports 77 cases of lung abscess following tonsillectomy and in 73 general anesthesia had been employed. His particular caution is that physical signs are most misleading, and the history, with careful roentgenograms, is most important. With the diagnosis once established, the co-operation of the bronchoscopist with the surgeon is most essential to institute treatment before the abscess develops rigid walls.

The lesson, as the author sees it, is simply greater care in careful technic of injecting a local anesthetic and in general anesthesia to avoid too deep a narcosis.

As to the time of operation, Rabey and Friedland (Arch. Int. Med., May, 1930) presented 165 cases operated upon during acute rheumatic fever. Bronchitis and bronchopneumonia were considered contra-indications but cardiac conditions were not so con-

sidered. Ether was used in the majority of cases. Results of the operation were brilliant in a number of instances.

The question of operating in the presence of acute inflammation of tonsils is one that has not been definitely settled. Likewise the question of operating in the presence of a peritonsillar abscess. The general consensus of opinion, as I have been able to obtain it, is still unfavorable to the procedure. While one may grant that the removal of the tonsil in the beginning of peritonsillar abscess may be logical and that there is a cleavage of tissues that facilitates rather than impedes the operation, the argument holds only during the early stages. Once the abscess is well formed, simple drainage seems the more logical course.

Pertinent to this particular phase of the discussion is the electrocoagulation of the tonsils. It is advantageous when properly used.

It is indicated when the patient's general condition materially increases the hazards attendant to ordinary tonsillectomy. It is to be recommended to those of advanced years when the tonsils should be removed. It is to be recommended to the patient who must remain at his work and cannot give the few convalescent days necessary to the ordinary operation. It has the disadvantage of a prolonged period of treatment. Without proper precautions and care it may be as painful as the ordinary tonsillectomy. With proper care and precautions one can eventually obtain a clean fossa, though several months may be required. Without proper care and technic, its hazards equal the ordinary operation.

BRONCHOSCOPY.

Jackson (J. A. M. A., 95:639, Aug. 30, 1930) calls attention to the different types of bronchial obstruction and explains the mechanics that present the various types. He compares the expanding and contracting thorax to a reciprocating pump, and the bronchial obstructions to various types of check valves. To properly interpret physical signs, one must have a comprehension of the causative factors and a realization that the mechanics of the same may change or alternate, resulting in emphysema or atelectasis.

Funk and Clerf (*Med. Clinics N. A.*, 13:833, Jan., 1930) have discussed the difficulties of physical examination and called attention to the fact that in the majority of cases bronchoscopy offers the only means of an accurate diagnosis.

The literature abounds with reports of tumors, simple and malignant, of the trachea and bronchi. Funk (*J. A. M. A.*, Dec., 1930) emphasized the value of bronchoscopy in diagnoses, and declares it to be the most important advance in thoracic diagnosis.

McCrae (*Arch. Otolaryn.*, Dec., 1930), in discussing the clinical features of neoplasms of the bronchi, states that cough is almost invariably present, pain in 75 per cent and hemoptysis in 50 per cent of cases.

It is from a more general appreciation of the value of the bronchoscope as a means of early diagnosis that bronchoscopic treatment will have the opportunity to demonstrate its true treatment value. Magnus (*Arch. Otolaryn.*, Dec., 1930) believes that irradiation, though the results are not universally good, probably offers at the present time the best therapeutic means of combating bronchial neoplasms.

The thickened, rigid walls of an old lung abscess offer a most baffling problem, and as Holeman (*Arch. Otolaryn.*, March, 1930) emphasized, the most favorable time to cure a lung abscess is immediately after its inception.

Bronchoscopy renders postural drainage more effective, and through this means strictures may be dilated and obstructive granulations removed. Attention to these facts has been called by Carmody, Schall, Funk, Clerf and others.

In the opinion of Jackson, the fundamental factor in pulmonary pathology is the impaired defensive power of the lung due to impaired drainage and deficient aeration. Bronchoscopic drainage, according to McCrae, is the treatment to be tried first. Even in advanced bronchiectasis, it is more generally recognized that patients can be benefited by this treatment.

In the removal of foreign bodies a more general appreciation of the advantages of fluoroscopy, in conjunction with bronchoscopic technic, is worthy of mention, and, according to Smith, the excursion of the foreign body with the patient under general

anesthesia can be controlled by having an assistant fix the diaphragm on the side involved.

EAR.

The ear microscope of Dr. E. Luscher, University Clinic, Bern, has been described by Allen B. Potter (*ANNALS OF OTOTOLOGY, RHINOLOGY AND LARYNGOLOGY*, March, 1931). This instrument gives a means of studying the anatomy, physiology and pathology of the ear drum. Luscher's and Potter's studies may be partially summarized as follows:

There is a definite normal regulation of the blood flow out of the ear drum. The middle third pars tensa gives its blood toward the umbo and from there along the handle of the malleus over the cutaneous strips to the upper ear canal wall; the outer two-thirds send their blood toward the periphery. The pars flaccida has its own irregular stream. The most abundant blood supply is seen to come by way of the posterior fold. The portion of the membrane below the posterior fold has a more abundant blood supply than the corresponding part below the anterior fold. The vessels entering by way of the anterior and posterior folds seem to recognize the handle of the malleus as the dividing line. Following down each side of the handle of the malleus there is only an occasional crossing over, but at the umbo there is a fine interlacing. There is a similar distribution on the inner surface of the tympanic membrane, and the connecting vessels between the two play only a minor part. This quite constant arrangement of the blood vessels of the tympanic membrane gives a logical reason for the ideal position of the myringotomy incision and also the manner in which the same is made. By making the incision from above down, one can more easily avoid the vessels entering by way of the posterior fold, as they may course quite low across the posterior upper quadrant. By starting the incision from above, the upper limit of the incision is thereby limited. The incision should avoid the periphery of the membrane, be first downward, then slightly backward and then forward, in an arc of a circle, to a point well below the umbo. By avoiding injury to the vessels in the upper and posterior part of the myringotomy wound healing occurs more quickly.

MASTOIDITIS.

The question of mastoiditis and acute intestinal intoxication in infants has been presented to otolaryngologists by Dean Marriott, Lyman, Alden and others, and certain misconceptions have arisen in the minds of readers as to the position of these authors. The discussion as to the rôle mastoiditis plays as a causative factor seemed to almost divide the profession into two camps.

D. E. Wishart (J. A. M. A., Oct., 1930) has stated that in their studies over a five-year period, they believed they were studying, in Toronto, the same type of case as seen and reported in the United States. Their conclusions were that the majority of the children were without clinical evidence of respiratory infection at the time they were toxic, many remained without any ear infection, and the frequent abnormal appearance of the ear drums just prior to death was due to forcible ejection up the eustachian tubes. They advise against antrum puncture to establish a diagnosis, favor delay in any operative procedure and finally conclude that the disease is of intestinal origin and that the infection of the mastoid antrum is not the cause.

Carmack (ANNALS OF OTOTOLOGY, RHINOLOGY AND LARYNGOLOGY, March, 1930) reported on twenty-eight cases and concluded that acute mastoiditis may occur coincidentally with an acute respiratory and gastro-intestinal infection, and that—

1. It may become an important factor in the outcome of the patient.
2. The mastoiditis may remain as a focus of infection and have a deleterious effect on the gastro-intestinal symptoms.
3. That careful and frequent ear examinations should be made. With pathology present myringotomy is indicated. If improvement does not follow through drainage and the mastoid is involved, then antrotomy should be performed.

Looking at it from the standpoint of the therapist, the question of a causative factor is not so important as the incidence of mastoid involvement. In discussing this question with an able pediatrician of my own community, Dr. M. D. Ott, who has charge of an orphanage of 500 children, I asked him as to the incidence of mastoiditis in acute intestinal intoxication in his insti-

tution. He had observed approximately thirty-five such cases. In his private practice, over a much longer period, he had seen but three cases. It would seem that institutional life is a factor.

Careful survey of the literature fails to show anyone as claiming that mastoid infection is always responsible for acute intestinal intoxication, but it has been established that the incidence of mastoid involvement occurs frequently enough to demand careful observation of the ears during the disease. Also that, if present, the principles that govern one in eradicating any focus of infection should be followed.

I wish to report an observation of Dr. M. D. Ott, pediatrician to the Iowa Soldiers' Orphans' Home. In this institution several epidemics of gastro-intestinal disturbances (cholera infantum type), associated with dehydration and acute otitis media, have occurred. Myringotomies have been performed whenever the tympanic membrane was not normal. The discharge in these cases, when cultured, has shown a hemolytic streptococcus with a tendency to plugging.

Antrotomy has been recognized as a proper procedure and is still done. However, rather empirically, because of the indecision, for one reason or another, as to immediate antrotomy, the following procedure was tried: A 5 cc. Luer syringe, filled with normal salt solution and with the tip of the syringe covered with rubber tubing, was inserted into the auditory canal—the tubing acting as a washer to prevent any back flow. Myringotomy had, of course, preceded this procedure; and with the child face downward, head lowered, the normal salt solution was forced into the auditory canal with about as much pressure on the piston as one would use in a transfusion. Ott's idea was that washing through the middle ear with such a mild pressure would not add to the mastoid complication, would dilute the discharge and at the same time re-establish drainage through the short eustachian tube. It did accomplish this, as was evidenced by the flow of solution out through the nose. To his surprise, some of these very sick children showed a rapid improvement. Vomiting stopped and ability to take liquids and retain same occurred. In some, recovery has taken place without an antrotomy. In others

mastoid operation was necessary but performed when the child's general condition had improved.

At no time was this procedure used with an idea of supplanting an antrotomy, and it was only because of the improvement beyond expectations that in this institution it has become a rather routine procedure, partly diagnostic, partly therapeutic, but never with the idea that it will entirely displace operative procedures.

In these infants, disregarding the cause, there develops an anhydremia which is the result of an imbalance between water elimination and water intake in which desiccation of the body and its tissues follows. Diarrhea and vomiting increase the anhydremia. The deep breathing, so-called air hunger, without marked increase in rate, is pathognomonic of acidosis and is of grave significance.

Since the care of these infants requires the closest teamwork, the work of Hartmann should be of interest to otolaryngologists. As to the diarrhea, the treatment is based on the following conception, quoting a personal communication: "Infections almost anywhere in the respiratory tract during infancy seem to depress hydrochloric acid secretion in the gastric juice. This tends to occur chiefly in very young infants, infants with poor nutrition, and during hot weather. This decreased acidity is very often followed by a heavy growth of bacillus coli, high in the small intestinal tract and even in the stomach. We feel that it is this abnormal growth of bacillus coli which is the chief cause of the diarrhea. The principle of the treatment is to keep the stomach and duodenum as constantly as possible of an acidity which is bactericidal to bacillus coli. This is done by making up milk formulæ with a solution of lactic acid and sodium lactate, and feeding this solution, sweetened with dextrin or saccharine, between formula feedings."

Also is Hartmann's work in combating acidosis or alkalosis with dehydration of importance. His so-called buffer salt solution has the advantage over Ringer's solution in that it does not increase the chloride content and at the same time supplies the potential base to replenish the depleted blood bicarbonate. With it there is also the advantage that frequent chemical examinations of the blood are unnecessary, for while a potential alkalinizer, it

also aids the kidney, except in renal insufficiency, to excrete excess $B. HCO_3$ at a more rapid rate where there tends to develop a condition of alkalosis.

CHRONIC SUPPURATIVE OTITIS MEDIA.

The very fact that medical literature each year contains suggestions as to the modification of the radical mastoid operation is evidence of the fact that with the complete radical operation we have not attained our Utopia. There is a conservatism displacing the former radical era. This represents progress because it is a conservatism that does not attempt to displace entirely the radical operation, but rather to differentiate by more careful diagnoses those individual cases that are first a menace to the future well being of the patient, and secondly to differentiate those in which modified technic will relieve those subject to such a potential menace.

This progress is perhaps not so much as regards technic as it is to careful examination and the clinical differentiation, from experience, of those who really need radical surgery.

The radical operation is one to be employed where the possible danger to the individual's life outweighs the necessity for his retaining useful hearing, if that is still present. Secondly, the radical operation is not primarily one used to produce a dry ear, providing the persistent discharge after the operation does not endanger the patient's life.

Quoting Shambaugh: "It is the exceptional case of chronic suppurative otitis media in which there exists any serious menace of a possible complication. In all others simple local measures should be persisted in, even though it is apparent that by this treatment one may not expect a cure."

Disease limited to middle ear mucosa does not bring on complications. The ordinary central perforation has not the possibilities of caries and cholesteatoma. The discharge in itself is not indicative of the pathology present, but the granular residue and the cholesteatomatous flakes in the discharge are important. These, persisting after careful cleansing treatment, are indicative of bone involvement. Caries, if limited to the tympanum, is not of great import, but the decision as to such limitation is not

so easy and requires the most careful examination, clinical and by roentgenogram. Likewise the presence of cholesteatomata is not in itself an indication for radical measures, but only after satisfying oneself as to the size of the cholesteatomatous cavity and, if small, nature's ability to expel the exfoliated material. History of the patient needs to be carefully taken. Present and probably future residence is a factor to be considered. Pain, hearing, upper respiratory pathology, tinnitus, vertigo, headache and disturbed mentality are all part of the picture to be scrutinized before decision as to treatment is made.

The above represents a digest of recent literature, as I have interpreted it, and the progress that has been made lies in the fact that we are attempting to differentiate our treatment on more logical grounds.

Zinc ionization has received favorable and unfavorable comments during the past year. To settle the question as to any change in zinc content of the 2 per cent zinc sulphate solution during ionization, I suggested to Dr. Dean M. Lierle, head of the department of otolaryngology at the State University of Iowa, that perhaps some chemist could determine this for me. He very kindly co-operated. They are carrying this investigation much further than I suggested and will make a report at a later period. However, in .8 cc. recovered from the ear canal there was 5.31 milligrams of zinc, while in the controls or original solutions there was 4.53 to 4.54 milligrams of zinc. The zinc electrode has a tendency to dissolve during the ionization and this increases the amount of zinc in the solution, even though zinc may be deposited in the ear.

Quoting G. E. Shambaugh again (*Arch. Otolaryn.*, Dec., 1930): "After cleansing and removing detritus and attention to granulations and polypi, the instillation of boro-alcohol and the insufflation of dry powdered boric acid will accomplish anything that any other form of local treatment will do." But to those of us who can look back and recall the almost infinite number of medicaments that have had other advocates and been so recommended and now forgotten, we realize that we shall probably go on trying to catch this elusive medical will-o'-the-wisp.

The interest that has been aroused following the reports of M. D. Lederman regarding the use of iodized boric powder or iodine powder (Sulzberger) prompted me to make inquiry from others as to whether this is another will-o'-the-wisp or whether we have something that is to be permanently added to our armamentarium. Enthusiastic advocates in medicine often fail to have their results duplicated by their confreres, and this is the only measure of true worth.

No extensive survey has been attempted. Dr. Lederman kindly furnished me with a few names of men he knew were using it. The others to whom I wrote on my own initiative were kind enough to reply.

Lederman: Standard treatment in all cases of suppurative disease of the middle ear and nasal cavities after acute symptoms have subsided and suppuration persists. In after treatment of mastoid wounds.

Isaac Heller, Lebanon Hospital, New York: Gratifying results. Not a panacea. Reduces necessity for radical operation. Thorough drying and removal of detritus necessary.

H. S. Birkett, Montreal: Eight cases; large perforations and which had not responded to treatment; discharge ceased in a very short time.

T. E. Carmody: Using it after radical and simple mastoids. Too short a time to decide.

Perry Goldsmith: Many failures but quite enough surprising successes to feel there is undoubted merit in its use.

Dr. Bertram Danelius, Norway: Twenty cases; excellent results.

William V. Mullin: Enthusiastic about its use. Has cleared the infection in a good many chronic ears.

G. M. Coates: Believes it has merit. Too short a time to pass judgment as to the extent of same. Great care in cleansing a factor and with this care certain numbers of ears will become dry even without the powder.

Dr. Edmund P. F. Fowler, Manhattan Eye and Ear Hospital: With preliminary care and fresh powder, excellent results can be obtained. Some doubt as to whether any better than alcohol and boric acid.

John Shea: A valuable adjunct. Will not replace surgery. An ideal powder for the dry treatment.

Sam E. Roberts: Used it for ten years. Does not use it much but would not be without it. Works best when the secretion is limited. With profuse secretion prefers plain boric acid.

S. M. Hartzell, Youngstown: Six cases became dry; two with polypi, which were removed surgically.

James J. King, New York: Generally satisfactory results. Also used it in chronic maxillary sinusitis.

Isidor Friesner, New York: The choice of conservative treatments. Also in dressing radicals.

M. A. Goldstein: Very enthusiastic over its use.

W. G. Kenyon, Nashville: Twenty out of twenty-one cases treated became dry, with some slight recurrence easily controlled. Very enthusiastic.

W. E. Sauer, St. Louis: Very valuable addition to the treatment.

Dr. Joseph C. Beck, Chicago: Uses it in all cases. Some good results and some practically no results, particularly those based on cholesteatomatous formations.

Don M. Campbell: Very favorable action in many cases. Doubts that it really cures because of the pathology underlying many of these cases, and thinks cases should be followed.

G. M. Maness, Vanderbilt University: Best results of any treatment. Not a panacea. Valuable in postoperative treatment of radical cases. Fifty cases with six failures.

Ralph A. Fenton, Portland: Very favorable to its use in certain types of moist, odorous ears.

Guggenheim, St. Louis: Very enthusiastic about its use.

Dr. Sidney Yankauer, New York: "The powder as originally furnished was white, was efficient and practically substantiated all of Dr. Lederman's claims for it. As recently furnished, it is a light brown powder which is irritating and inefficient. As its composition is kept secret, I do not know the cause of the recent failure. Under these circumstances, I cannot continue to advise the use of this preparation."

This list of twenty men have all reported favorably on the use of Sulzberger powder. No adverse reports were received.

This, of course, does not establish any permanent position for the iodine powder treatment, but in the opinion of the writer, it stands today as the outstanding medicament used in the medical treatment of suppurative otitis media.

CHRONIC SUPPURATION OF THE MIDDLE EAR.

Conservative surgical measures based on a more careful analysis and selection of cases seems to be given more consideration as one scans the literature. It is not the attempt to survey all these measures. Even ossiculectomy, in the opinion of some, has its place. Tobey's attic mastoid operation, through the auricular canal, is familiar to you. The report of James A. Babbitt before the Section of Otolaryngology, College of Physicians, of Philadelphia, in April of this year, has seemed to the essayist to be one that should be mentioned. Quoting the author: "In chronic disease of the middle ear the attic space becomes badly damaged. It is conceded that at least the antrum of the mastoid shares the involvement. The squamous cell areas, promontory, ossicles and tympanic membrane afford special opportunity for fibrous change. The whole area may seem obliterated by thickening, sclerosis and adhesions, so that drainage downward from the intra ad antrum remains but a narrow tortuous channel, defying simple treatment. It seemed possible, if this upper posterior quadrant could be converted into an open, rather rectangular drainage space, even at further sacrifice of tympanic membrane but preservation of the annulus, that the trouble might spontaneously cease; that even diseased ossicles freed from surrounding pressure might regenerate or cover in their surface sufficiently to become innocuous and, even after this somewhat traumatic disturbance, carry audition value." In the selection of cases, Babbitt emphasizes that the mastoid should be in a quiescent state and that the sclerotic or eburnized mastoid should present the best prognosis.

In this modified attic drainage the procedure is to work from the posterior inferior quadrant, making a fresh tympanic membrane incision if the openings present do not correspond to this area; with blunt, right angled probes, working under part of the tensa and all of the flaccid membrane, a space in the posterior superior quadrant is reamed out. Overhanging membrane that

may be thought to interfere with drainage is removed. Avoid removing any portions of the malleus or incus. Finally a right angled curette is inserted to the neighborhood of the inter ad antrum and any blocking granulations are curetted away. The author notes the proximity of the facial, but has failed to have had any complications due to disturbing this nerve. He also differentiates this procedure from an ordinary attic curettage and claims better results.

The case reports submitted are those of twenty-six ears. As to duration of discharge—with the exception of two, in what seems an incredibly short time for such an operation, ten days and two weeks, respectively, and two of six and seven weeks—they were all of a considerable length of time, from a year to fifteen years. Eighteen, or 69.2 per cent, became dry, four of the remaining showed 80 per cent improvement, and four were doubtful. Time, as the author states, may not give quite as high a percentage of dry ears. The simplicity of the procedure has special merit. Future observations and confirmation of results accomplished by others will, of course, establish the status of this procedure.

PETROSITIS.

Quoting Joseph Druss (*Laryngoscope*, June, 1931): "Belonoff and Belan of Bulgaria studied grossly the petrous pyramids and found the apex structure to be pneumatic in 35 per cent, diploetic in 22.5 per cent and mixed in 42.5 per cent—figures which correspond quite closely to Zuckerkandl's figures as regards the mastoid. But it does not follow that the structure of the mastoid and petrous apex will be the same."

Eagleton (*Arch. Surgery*, 1930) explains that irritation originating in the external two-thirds of the temporal bone, middle ear, mastoid and labyrinthine area, while not connected with the Gasserian ganglion, may have pain referred along some of its branches. Further, that facial pain in suppurative disease cannot come from posterior fossa inflammation and that the sensory root of the fifth in the posterior fossa is not affected from bone inflammation. His studies have demonstrated the firm adherence of the ophthalmic branch of the fifth to the dura and to the cavernous sinus and the adherence of the dura to the bone of the petrous

apex. This is not the case with the second and third branches. This gives a logical reason for retro-orbital neuralgia, with inflamed dura and consequent dural pulling.

Profant, in his studies of the petrous pyramid, considers the petrous pyramid cell the same as the mastoid cell, a cavity lined with thin mucoperiosteum, and that the development is coincident with and analogous to the development of the mastoid. His measurements have shown the distance from the petrosal cells to be less from the hypotympanic space—7 mm. than from the epitympanic space—10 mm., and that there are two fundamental routes in the process of pneumatization—the epitympanic and the hypotympanic.

Eagleton (*Arch. Otolaryngology*, March, 1930) makes a distinction between the petrous bone and the mastoid cavity in its pneumatization. He states that the purpose of the petrous apex in its growth in conjunction with the sphenoid and occipital is to widen and deepen the cranial fossa. Also that the petrous apex in fulfilling this function is the same as any long bone of the body and that normally its matrix is filled with cellular marrow placed between layers of compact bone. He considers pneumatization a process engrafted into the medullary substance by direct extension from the middle ear. He makes distinction between the type of suppuration in the mastoid and the petrous bone.

The petrous bone, according to Eagleton, receives its nourishment from periosteal loops and is without a central nutrient artery. The tip constitutes the active growing part. His contention is that when infection occurs, as in coalescent mastoiditis, the condition is not one of osteomyelitis but of suppurative osteitis, there being no marrow spaces in the mastoid. In contradistinction, infection and suppuration in the petrous bone is a destructive lesion in the medulla of a rapidly reproductive bone. While in the mastoid the cleaning out of the cavity of the diseased bone is essential, in the petrous bone simple drainage offers a much better prognosis as to the control of the infection.

As Kopetzky emphasizes, the series of events which are usually characterized by the term Gradenigo's syndrome, are not characteristic of a specific lesion and do not form a distinct clinical entity. Otogenic paralysis of the abducens is not diagnostic of

affections of the pyramidal tip and in itself does not furnish indications for operative procedure on the pyramidal tip.

Kopetzky divides suppuration of the petrosal pyramid into two varieties:

(a) Frank suppuration of the pyramid, more particularly the tip.

(b) Osteomyelitis of the pyramid.

Kopetzky, following the teaching of Witmaack, considers the infantile mastoid as spongy bone containing marrow between its trabeculae. Pneumatization is a process brought about by an ingrowth of subepithelial embryonal connective tissue. This tissue displaces the marrow. The pneumatic cells in a well pneumatized temporal bone are by no means limited to the mastoid portion. Thus it is reasoned that wherever there are marrow spaces in contact with tympanic mucosa the latter is capable of exerting a pneumatizing influence.

The carotid canal in the petrous bone at first lies below and in front of the cochlea and middle ear, then behind and internal to the eustachian tube. The avenues of infection, according to Kopetzky, are from the peritubal cells, from peritubal cells via the carotid canal and from the antrum or epitympanic space via, above or below, the superior semicircular canal. Kopetzky and Almour favor this latter route as the logical one. All of Kopetzky's and Almour's cases had extensively pneumatized mastoid processes. They feel that the presence of extensive pneumatization in the temporal bone should help one in anticipating later signs and symptoms should they appear.

That pain so characteristic of petrosal tip suppuration is described as just above or through the eyeball. "It is on the side of the lesion, is limited, nocturnal in character and is constant. Pain felt in the orbit due to irritation of the ophthalmic division of the fifth nerve must be caused by a lesion directly proximal to the nerve, for it has no connection with other sensory nerves in the petrosa.

When surgical removal of the purulent focus in the mastoid process and the middle ear does not relieve a pain distributed over areas supplied by the second and third branches of the fifth,

the fact should be viewed as suspicious of petrosal tip suppuration.

In Kopetzky and Almour's cases the discharge from the middle ear continued following the simple mastoidectomy, or after a period of dryness a profuse discharge made its appearance at the same time or shortly before the onset of the eye pain. In these cases the avenues of invasion were from the tympanic area, but with the exception of two the avenue of exit was by means of a channel self created by the peritubal cells. Patients with petrosal tip suppuration suffer from a low grade sepsis, and this condition, continuing after a mastoidectomy and associated with eye pain and discharge, is strongly corroborative as to petrosal suppuration. Particularly misleading is the period of quiescence during which there is freedom from pain and the patient and doctor are lulled into a position of false security. This is, according to the above mentioned authors, to be compared to the relief from pain that occurs in an acute coalescent mastoid where perforation and a subperiosteal abscess occur. With perforation through the upper surface of the petrous or through the thin bony partition of the carotid canal, a subdural abscess forms and relieves the inflammatory tension on the dura.

With secondary increased tension occurring with invasion of the subarachnoid space, pain will again manifest itself. This latter pain, however, affects all sensory nerves and assumes the type of a generalized headache. If operative measures are to be successful they must be instituted before the period of quiescence. In none of Kopetzky and Almour's cases was the abducens involved. Other observers, Eagleton included, have had the same experience. In other reported cases the involvement of the sixth nerve has occurred. However, its occurrence is not significant of petrous tip inflammation; in fact, Kopetzky and Almour consider that involvement of the abducens argues more for a mild type of meningitis.

Bacterial differentiation, the blood picture and spinal fluid examinations are without significance in this condition. The X-ray does, however, give valuable information as to structure and involvement of the petrous bone. A differential point from re-

infection of the mastoid wound is, first, the lack of signs of increased inflammation about the wound, no increase in wound discharge and that after the ear canal has been wiped clean, pressure over the healed scar does not cause pus to pour into the middle ear.

Access to the Gasserian ganglion region and petrosal tip is not one of easy surgical approach. Prior to Eagleton's technic they were all directed through the middle cranial fossa and were content with simple exposure of the tip in search for an epidural abscess. Kopetzky quotes the one exception, Mayer's case in which recovery followed the enlarging of an opening at the eustachian orifice with subsequent probing and release of pus. This technic was not premeditated but simply the investigation of pus coming from the floor of the tympanic cavity.

Eagleton's operation follows the radical mastoid operation and the removal of the so-called anterior and posterior buttresses. The difficulties of exposure of the petrous apex are thereby materially lessened. With this accomplished, he is not satisfied with exposure of the apex but enters the tip directly by means of a hook, makes an opening in the roof and establishes drainage from the suppurating area to the outside via the middle cranial fossa.

Almour's operation provides a technic which avoids entering the middle cranial fossa and the hazards of subdural drainage. His technic first requires the radical operation, search being made at the time for avenues of entrance in the epitympanic area. If a fistulous tract is discovered it is widened, curetted and probed and with a flow of pus obtained, drainage is attempted through the avenue of invasion. Injection of lipiodol has exerted a sterilizing effect on the suppurating area. Otherwise the surgical approach is via the peritubal cells. The first essential is a free and unobstructed view of the tympanic orifice of the eustachian tube. This is accomplished by thinning down the anterior wall as much as possible without opening into the glenoid fossa and the removal of the zygomatic root to the level of the tegmen tympani. From this point the surgical technic required demands the utmost of the operator's knowledge of applied anatomy and his ability to orientate himself so as to apply this knowledge to the patient

before him on the operating table. The path of surgical entry lies between the cochlea, the eustachian tube and the carotid artery. From anatomical specimens, Almour contends that while near the floor of the eustachian tube, the basal coil of the cochlea is within 1 mm. of the ascending portion of the carotid canal; that when the carotid canal starts to bend forward the basal coil turns upward and that directly beneath the superior surface of the petrosa there was always a minimum space of 6 mm., maximum of 9 mm., and an average of $7\frac{1}{2}$ mm. in fourteen specimens examined. He furthermore contends that this space is increased 2 mm. because this represents the thickness of the bony cochlea.

Entrance is made through the base of a pyramidal space, the base being the superior petrosal surface, and the apex situated downward is formed by the convergence of the basal coil of the cochlea, the lowest portion of the inner wall of the osseous eustachian tube and the bend of the carotid canal. It is Almour's claim, supported by Kopetzky, that the tip of the petrous pyramid can be reached through this approach, providing the direction of entry parallels a line drawn between the apex of the cochlea and its basal coil. The applied application of his studies is made by using a one to one and one-half mm. burr, placing the same as high as possible directly at the mouth of the eustachian tube and in a position so that the drill handle forms an angle of twenty to twenty-five degrees with the axis of the external auditory canal. With gentle pressure drilling is made to a depth of three to five mm., when the sensation of entering a cavity is transmitted to the operator's hand. A fine, blunt probe is then used to break up granulations within the petrosa, and while pus usually appears after opening with the drill it has always made its appearance after manipulation with the probe. Certainly one can have only the greatest admiration for the work of Eagleton, Kopetzky and Almour in the development of suppurative of the petrous pyramid as a clinical entity. What the ultimate position of Almour's surgical technic will be time alone will establish, but to the casual observer the delicacy of surgical technic required in immediate proximity with such structures as the carotid artery and cochlea, would seem to be its greatest handicap in the hands of the average operator.

INTRATEMPORAL SUTURE OF THE FACIAL NERVE.

R. C. Martin (Arch. Otolaryn., Feb., 1931) reports a method of intratemporal suture of the facial nerve. He gives credit to Bunnell, who in 1927 reported a successful suture of the facial nerve within the temporal bone.

MENINGITIS.

Any ray of hope in the treatment of otitic meningitis receives a most cordial welcome. Serous meningitis is potentially septic.

Haynes' operation for continuous drainage through the cisterna has never been greatly accepted. Spurling reports five cures in eight cases following laminectomy and the forced intake of fluids up to four to five liters daily. He claims to provide a portal of exit for drainage of inflammatory products to relieve pressure and a dilution of toxins by increased water intake with consequent lavage of the central nervous organs. F. C. Grant tried the same treatment with no recoveries.

The question of lumbar puncture is a controversial one, but as one reads one concludes that the ayes are in the ascendancy. Hemstead (ANNALS OF OTOTOLOGY, RHINOLOGY AND LARYNGOLOGY, June, 1931) reviews the question and states that at Rochester they have seen no ill effects from repeated lumbar puncture. He reports two cases, one with hemolytic streptococci in the spinal fluid, which recovered and in which he and his colleagues felt that repeated spinal punctures were responsible for the good results obtained.

The experimental work of Kolmer in the intracarotid method of treatment in an effort to bring a therapeutic agent into immediate contact with meninges, is of more than passing interest. In experimentally produced meningitis in animals he was able to obtain forty to sixty per cent recoveries. In the eleven cases reported by him before the College of Physicians of Philadelphia, nothing was accomplished in the streptococcic cases, seven in number, and of the four pneumococcic cases there was one recovery. This is not a promising report itself, but the immediate relief afforded was striking, though recovery was not accomplished. He found reliable scarlet fever antitoxin better than the polyvalent serums in the streptococcic cases. In the pneumococcic cases

Felton's serum was used and in the one recovery the organism proved to be Type 1. It also offers a method of introduction in cases resistant to intraspinal medication in meningococcic meningitis. The artery is exposed surgically and injection is made with a No. 22 needle, there being no ligature used, no hemorrhage and no danger, according to Kolmer. He feels that with early treatment much better results could be obtained. In using Felton's serum, 10 to 12 cc. were injected into each common carotid. To this was added 1 cc. of 1:200 ethyl hydrocuprein hydrochloride. In his experimental work, as to specific prophylaxis in streptococcic and pneumococcic meningitis, Kolmer was able to show the benefits derived from the use of Felton's serum on animals. With Type 2 at least double the dosage to control in Type 1 was necessary. Streptococcic therapeusis remains less effective. It is Kolmer's conviction that in pneumococcic infections of Type 1, the injection of Felton's serum intravenously may prevent the involvement of the meninges, and that in the presence of meningitis intracarotid therapy has some merit without any extra hazard to the patient.

PHYSIOTHERAPY.

Physical and electrotherapy in otolaryngology has gained a definite place, but the evaluation of its real merits has been clouded by the enthusiastic claims of manufacturers' representatives and overenthusiastic members of the medical profession. This has led to a skepticism on the part of many.

The removal of the faucial tonsils by means of electrocoagulation has a limited field but a field that is to be recognized. Nasopharyngeal atresia and anterior nasal atresia are particularly applicable to electrosurgery. Lee Cohen, before the last meeting of the Triological Society, reported a case of complete nasopharyngeal atresia in which three types of electrocurrent were used. The cutting current, passed through heavy silver wire; the electrocoagulation current to remove scar tissue filling the nasopharynx, and the desiccating current to cover opposing surfaces with a dry eschar until healing took place. Dessication has a definite place in the removal of angioma within the nose, and the destruction of septal vessels which cause recurrent epistaxis.

Probably one of the greatest fields for the high frequency current is in malignancies of the maxillary sinuses and of the tongue. Lynch used electrosurgery without thyrotomy in four cases of early carcinoma involving the vocal cords.

Beck has devised a long needle that is covered, except about 2 mm. at the point, with a dielectric compound. In cases of intumescent and hypertrophic inferior turbinates this needle is used as he states for intramural electrocoagulation. The needle is thrust into the head of the turbinate and pushed along the medial aspect, hugging the periosteum to the posterior part of the inferior turbinate. The purpose is to produce a linear scar without destruction of the epithelium, without the danger of synechia and hemorrhage. His results, which have been corroborated by others, have been most satisfactory.

Hurd has devised a bipolar electrode consisting of two terminal needles, 4 cm. in length, which are inserted into the turbinal tissue as the Beck needle, a coagulating current applied until a white area is seen about the needle at the site of puncture. Hurd thinks there is an advantage in each needle acting as a pole of the electrode and that only that portion of the submucosa between the needles is coagulated.

It is hardly necessary to discuss the advantages of the cutting current in dealing with malignancies. Nasal synechia can be overcome as by no other method. The reduction of lymphoid tissue, postoperative granulations, enlargement of the lingual tonsil and lingual varicosities yield nicely to electrocoagulation.

The air-cooled quartz lamp is of decided value, but the bactericidal qualities of the water-cooled lamp are at a decided disadvantage in dealing with the interior of the nose and its accessory cavities because of the necessity of direct application of the rays and the limited penetrability of the rays through mucous membrane.

Heliotherapy in laryngeal tuberculosis through the means of artificial sunlight by the modified carbon arc light has received the enthusiastic endorsement of those men who have had the opportunity to use the same in the Hajek clinic in Vienna.

Joseph W. Miller of New York (*Arch. Otolaryn.*, March, 1931) reports his results in using the Wessely radiation machine

which he was the first to import from Vienna. Only two out of seventy-four cases failed to respond, and fifty-nine of the remainder showed complete healing and thirteen were subjectively better or showed partial healing.

Medical diathermy is simply a means of supplying heat to some part of the body and a means by which the point of greatest heat activity can be submerged below the external surface. Properly used it is admirable to relieve pain; improperly used, it is capable of harm. Its chief contraindication is pus in an enclosed cavity without drainage. It seems to be fairly well established that in acute mastoiditis it does harm, while in acute sinusitis temporary relief from pain is accomplished without ill effects, even though the sinus cavity may contain pus and is not draining well.

NEW PUTNAM BLDG.



Emil Mayer



EMIL MAYER.

Dr. Emil Mayer, distinguished laryngologist and a member of the ANNALS staff since 1916, died in New York on October 20th, in his seventy-eighth year.

In the fifty-four years of his active practice, he was an indefatigable worker and was prominently associated with many laryngological societies and institutions. Graduating in 1870 from the College of the City of New York, he turned first to pharmacy. Following his graduation in medicine in 1877, he became Assistant Surgeon in the New York Eye and Ear Infirmary and Surgeon in the throat department of that institution thirteen years later. He was at various times Chief of Clinic, Attending Laryngologist and Consulting Laryngologist at Mt. Sinai Hospital, lecturer in the New York Polyclinic and expert examiner City Civil Service Committee in the City of New York.

His name often figured prominently in the social functions which marked the visits of distinguished foreigners to this country, among them the long remembered dinner to Sir Felix Semon at Delmonico's in 1905.

He was the American representative to the Fraenkel Birthday Celebration in 1906, when he was made an honorary member of the Berlin Laryngological Association. Besides his position as collaborator on the Editorial Board of the ANNALS, he contributed frequently to the editorial pages of other journals, held the position of abstract editor of the American Laryngological Association for several years, and was a member of the editorial staff of the *Centralblatt für Laryngologie* until the attack of this publication upon Sir Felix Semon regarding his attitude on the sinking of the Lusitania prompted Dr. Mayer's resignation from that journal.

He was a member of the Section on Laryngology of the American Medical Association, the New York Academy of Medicine, and the American Academy of Ophthalmology and Otolaryngology, of which he was president in 1921.

In 1922, Dr. Mayer was elected president of the American Laryngological Association, and in 1927 he became an Honorary

Fellow of the American Laryngological, Rhinological and Otolological Society. In the last ten years of his life he interested himself in the study of local anesthetics and collected extensive data upon the fatalities from these drugs. He was chairman of the Permanent Committee on Local Anesthesia of the Therapeutic Research Committee of the American Medical Association from 1924 until the time of his death. He contributed an extensive survey of the subject to the Loeb memorial number of the *ANNALS*, which appeared in March, 1928.

His genial nature and his unfailing interest in the progress of laryngology—even in the sad retirement of his declining years—endeared him to his younger friends, as to those of his own generation.

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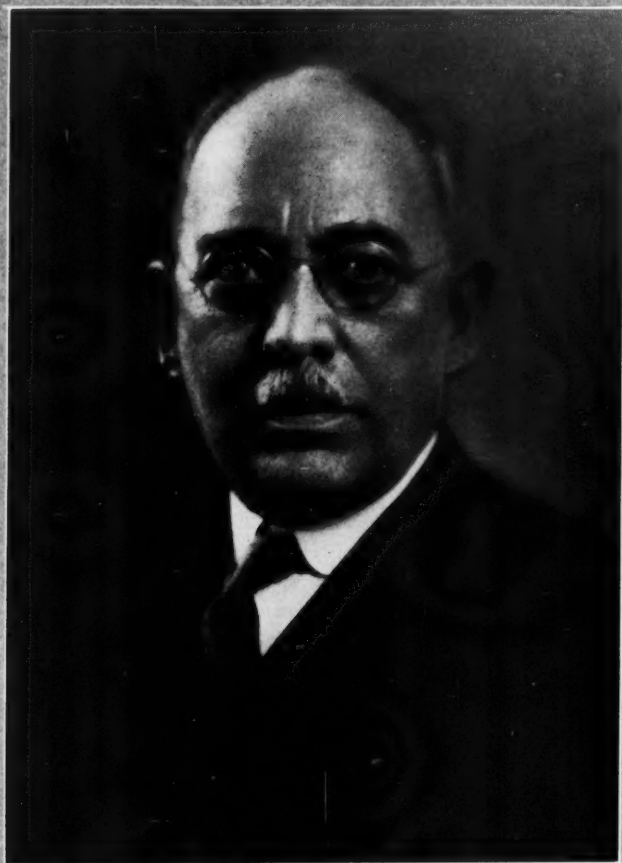
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HUBERT ARROWSMITH



HUBERT ARROWSMITH.

Dr. Hubert Arrowsmith of Brooklyn died there on August 9, 1931, in his sixty-sixth year. A pioneer in bronchoscopy, Dr. Arrowsmith was a founder of the American Bronchoscopic Society. He had practiced medicine continuously in Brooklyn since he was graduated from the Long Island College Hospital, where he received his degree in 1886.

Dr. Arrowsmith was a Fellow of the American Laryngological Association and a member of the American Laryngological, Rhinological and Otological Society, the American Academy of Ophthalmology and Otolaryngology, the American Bronchoscopic Society, the American College of Surgeons and the American Medical Association.

About two years before his death Dr. Arrowsmith virtually retired from active practice. Prior to that time he was laryngologist to Kings County Hospital, St. Peter's Hospital, the Brooklyn State Hospital, the Jewish Hospital, the Brooklyn Hospital and St. John's Hospital, all of Brooklyn. He was also consulting laryngologist at the Huntington Hospital, Huntington, L. I., and St. Anthony's Hospital in Wood Haven, Queens.

He is survived by his widow, Mrs. Josephine Howard Arrowsmith, three daughters, the Misses Miriam and Eleanor Arrowsmith, and Mrs. John Keith Baker of 51 South Oxford street, Brooklyn, and by a sister, Miss Edith Arrowsmith.

THE PUBLICATIONS OF HUBERT ARROWSMITH.

1. A Clinical Study of Seven Hundred and One Cases of Nasopharyngeal Adenoids Observed in Two Thousand Dispensary Cases. *N. Y. Med. Jour.*, Aug. 28, 1897.
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28. Gangosa. *Laryngoscope*, November, 1921.

AMERICAN BOARD OF OTOLARYNGOLOGY.

An examination was held in Indianapolis, Ind., September 12, 1931, just prior to the meeting of the American Academy of Ophthalmology and Otolaryngology, held in French Lick, Ind. Forty-three candidates were examined, of which nine were conditioned or failed.

The Board will hold an examination in New Orleans on May 9th, during the meeting of the American Medical Association, and in Montreal, next fall, just prior to the session of the American Academy of Ophthalmology and Otolaryngology.

Prospective applicants for certificates should address the Secretary, Dr. W. P. Wherry, 1500 Medical Arts Building, Omaha, Neb., for proper application blanks.

H. P. MOSHER, M. D., President.

W. P. WHERRY, M. D., Secretary-Treasurer.

Abstracts of Current Articles.

The Second International Congress of Oto-Rhino-Laryngology will be held at Madrid, September 27 to 30, 1932, under the presidency of Professor A. G. Tapia.

The questions, and those designated to present reports are as follows:

Otosclerosis:

J. S. Fraser, Edinburgh; Gordon Wilson, Chicago; Otto Mayer, Vienna.

Ozena:

- a. *Etiology, Pathogenesis, Bacteriology (Results of an International Inquiry)*: Leroux-Robert, Paris; Costiniu, Bucharest.
- b. *Medical Treatment*: Viggo Schmidt, Copenhagen.
- c. *Surgical Treatment*: Lautenschläger, Berlin.
- d. 1. *Pathologic Anatomy*: Luigi Torrini, Florence; 2. *Bacteriologic and Experimental Research*: P. Margolis, A. Trimarchi, Cremona.

Scleroma:

- Results of International Inquiry—Geography, Statistics, Epidemiology*: Belinoff, Sofia; Szmurlo, Poland; Serger, Denmark.
- Bacteriology*: Lasagna, Parma.
- Clinical and Therapeutic Report*: Bourack, Minsk.
- History*: Hajek, Vienna.
- International Legislation*: Barraud, Lausanne.
- Prophylaxis*: Zaloskey, Poland.
- The War and Rhinoscleroma*: Putschoski, Russia.
- Etiology*: Hinsberg, Breslau.
- Serology*: Neuber.

Endoscopic Treatment:

- a. *Of Suppurative Tracheobronchial Affections*: Jackson, Philadelphia.
- b. *Of Inflammatory Lesions of the Esophagus and Vicinity Caused by Foreign Bodies*: von Eicken, Berlin.

Treatment of Tumors in Otorhinolaryngology by Penetrating Radiations (X-rays, Radium):

- a. *Respective Indications for Radiation and Surgery*: Hautant, Paris.
- b. *Technic of Use of Radiation*: Ledoux and Sheys, Brussels.
- c. *Treatment of Malignancy of the Tonsil*: Lemaitre, Paris.

For all information, apply to the Secretary General, Dr. A. Fumagallo, Argensola 16-18, Madrid, Spain.

The Fifth International Congress of the "Collegium Oto-Rhino-Laryngologicum" was held in Bordeaux, July 19 to 22, under the presidency of Professor Georges Portmann. Reports were

rendered by Ledoux of Brussels on the radiosensitiveness of tumors according to their histologic types; and Guild of Baltimore on the correlation of histologic observations in the acuity of hearing. Professor Benjamins of Groningen is Secretary.

Syphilis of the Esophagus (La syphilis de l'oesophage).

R. Guyot (Zürich), Ann. d'Oto-lar., 1:505, May, 1931.

Careful study with pathologic reports of two recent cases. Three different forms are recognized: (1) The submucous gumma, ulcerating through; (2) Propagation of syphilitic involvement of a neighboring organ—adenitis, aortitis, phlebitis, luetic pneumonia; and (3) Chronic diffuse esophagitis, superficially ulcerating. All these may end in stenosis; lesions are generally in the upper third. Progressive dysphagia is the main symptom; diagnosis is made by exclusion of more common causes, including endoscopy, confirmatory Wassermann and biopsy. Prognosis depends on the nature of the involvement and question of re-establishment of passage by progressive dilatation, coupled with response to antiluetic medication. F.

Laryngeal Epithelium Treated by Thyrotomy and Laryngostomy with Direct Radiotherapy and Electrocoagulation (Epithelioma Spino-cellulaire du larynx, etc.)

Drs. Texier, Lèveil and Viel (Nantes), Ann. d'Oto-lar., 1:404, April, 1931.

Case report since 1926 of a ventricular epithelioma for which the larynx was first given external radium X-ray therapy without result. Thyrotomy and instrumental removal were followed by radium therapy, and later by a good-sized laryngostomy, through which small recurrences were coagulated during a year's time. The patient, now 69, has been well for two years and has a good speaking voice when the opening is closed. Plastic closure is to be done shortly. Excellent diagrams, dosage reports of the radiotherapy and excellent biopsy reports are given. F.

Ocular Pain in Suppurative Otitis (Le symptôme "douleur oculaire" au cours de l'otite moyenne suppurée).

Dr. H. Caboche (Paris), Ann. d'Oto-lar., 1:649, June, 1931.

Differing from Moulouquet, who considers pain in the eye an immediate indication for radical mastoid surgery, when observed in the course of an acute otitis, Caboche reports a case in which

the child complained bitterly of ocular pain, especially while eating. There was no headache and the child's general condition was good. No local mastoid symptoms were observed; the discharge continued ten months. Another acute attack the following year produced dental pains, but cleared up promptly after paracentesis. Caboché recognizes the necessity of operation in grave mastoid involvement, where actual purulent invasion of the petrous tip is feared, with invasion of the Gasserian region. He is inclined to ascribe these pains in mild cases to toxic irritation of Jacobson's nerve in the tympanum and propagation of this pain to the neighboring fifth nerve center in the medulla. It is always a danger signal of considerable moment, in his judgment.

F.

Biologic Considerations Regarding Cancers Which Get Worse After Radiation (Consideraciones biológicas sobre los canceres ecc.)

Prof. V. Fairén (*Strasbourg*), *Rev. Esp. Amer. L. O. R.*, 22:11, January, 1931.

Sclerosing effects after radiation maintain the lymph channels open in certain cases so that cancer cells may readily traverse them. Also the slow process of healing, with very slow elimination of toxic products, reproduces irritation which may condition regrowth. Macrophages and other reticulo-endothelial cells are destroyed and with them the main defensive mechanism of tissue repair is lost; purulent invasion and foul granulations are favored in such cases. Fairén's work is based on tissue cultures as well as study of sections from irradiated growths of the tonsil and larynx.

F.

Leprosy of the Upper Respiratory Tract and the Ear (Die Lepra-erkrankungen der oberen Respirationswege und des Gehörorgans).

Prof. A. T. Bondarenko (*Irkutsk, Siberia*), *Otolar. Slav.*, 3:131, April 1931.

Careful study of cases in the Leprosarium for Eastern Siberia leads Bondarenko of the University of Irkutsk, after an exhaustive comparison with previously published reports, to the following conclusions:

Lepra bacilli are found three times as frequently in the nasal secretion as in the tonsils. Pathologic and anatomic changes are especially well developed in the nose (turbinates, septum); then come the tonsils, pillars, soft palate and epiglottis. The number

of lepra bacilli noted on histologic examination is reduced in the same order of frequency.

The hooked-tip nose is the most frequent nasal deformity, then the "lorgnette" nose, with very large alæ and normal bridge, and lastly the flattened nose.

The faucial tonsils are rarely large and are, in fact, generally atrophic.

Specific changes are found in the upper nasopharynx in 40.9 per cent of cases.

Purulent otitis media is rarely found among lepers.

Among persons of the same nationality from the same vicinity, the concha of lepers is two to three times larger than normal.

Changes in hearing (in 66 per cent of cases) consist of shortened bone conduction, normal air conduction, and considerable reduction in hearing of the whispered voice. Labyrinth tests disclose severe subjective disturbances. F.

Heliotherapy and the Quartz Lamp in Postoperative Treatment of Mastoid Wounds (Sul l'azione dei raggi solarie della lampada di quarzo nella cura postoperatoria delle affezioni mastoidee).

Prof. G. Tenaglia (Milan), Arch. Ital. O. R. L., 42-152, May-June, 1931.

For improving the appearance of granulations and hurrying the healing of large mastoid cavities, Tenaglia prefers to expose the wound to direct sunlight after the sixth postoperative day, beginning with an hour or two, finally leaving it uncovered all day except at meal time.

The quartz lamp has not been helpful locally, though general body exposure has a good effect. There is too strong an admixture of ultraviolet rays to permit of healthy repair in bone wounds except with minimal dosage. F.

LeMeé and Worms (Paris) have just published in book form the results of an exhaustive questionnaire on indications for tonsillectomy, operative methods, results and complications. They incline toward American methods and conclusions, differing from most of their European confrères. LeMeé (*Arch. Int. Lar.*, July, 1931) reports on his results in 971 recent tonsillectomies in children; he prefers the modified LaForce tonsillectome, devised by Popper of London, to the original Sluder method. The latter he finds much too bloody, and he points out that speed is not necessary, preferring good hemostasis. F.

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